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EXHIBIT C

RESPONSE TO UNIVERSITY OF ROCHESTER INVESTIGATION COMMITTEE'S DRAFT REPORT

RESPONSE SUBMITTED BY:

PROFESSOR LIYANAGAMAGE R. DIAS, PHD

RESPONSE ISSUED: JANUARY 29, 2024

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Preface

In addressing the allegations and findings of the Investigation Committee appointed by the University of Rochester, this report humbly examines, with respect and careful consideration, the complexities and implications associated with the Committee's composition, conduct, and potential biases. My intention is not only to defend my professional integrity but also to emphasize the essential need for impartiality, expertise, and fairness in the investigative process, especially in the specialized field of low-temperature, high-pressure superconductivity.

The tone of my response, as reflected in the subsequent sections, stems from a deep concern for the preservation of my career and reputation, which I respectfully believe may be unfairly at risk due to the Committee's approach. This response is a reaction to what I perceive as threats to my professional standing and the integrity of my scientific contributions.

Section V of the report thoughtfully explores the Investigation Committee's composition and expertise, raising respectful concerns about their specialization in shock physics as opposed to the nuanced field of low-temperature, high-pressure superconductivity. The discrepancy in expertise, coupled with potential conflicts of interest as outlined in Section B, not only raises questions about the Committee's ability to conduct a well-informed and unbiased investigation but also highlights areas where their analysis and conclusions may be inadvertently misinformed due to a lack of direct experience in my field.

Moreover, the report considers the University's role and its potential influence on the investigation. Actions like the unilateral removal of students from my supervision and collaboration between university officials in activities that could be perceived as prejudicial against me underline the necessity of a fair and impartial inquiry, free from preconceived notions or institutional biases.

Sections VII to IX thoughtfully discuss the Investigation Committee's omissions, confrontational approach, and access to resources, indicating elements that might affect the integrity of their findings. These sections also detail how the Committee's limited experience in low-temperature, high-pressure superconductivity might have led to incorrect analyses or conclusions. I offer insights into my challenges with the English language and the circumstances leading to the adversarial nature of my interactions with the Committee, to provide context to my stance.

Considering the concerns previously expressed, it is crucial to consider the outcome-driven and result-oriented nature of the investigation led by the University of Rochester. This aspect not only intensifies the challenges I face but also casts doubt on the legitimacy of the process and the integrity of academic research, especially considering the possibility that the Committee's lack of direct experience in my field might have influenced their findings.

The establishment of the Investigation Committee by the University of Rochester is an important issue, especially concerning the members' experiential qualifications to competently review research in the specialized field of low-temperature, high-pressure superconductivity. The Committee's expertise in shock physics, while commendable, may not provide the necessary understanding to accurately evaluate and interpret findings in my field. This discrepancy in

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expertise is significant and impacts the investigation's credibility, fairness, and the accuracy of its conclusions.

My concerns also encompass what appears to be an outcome-driven agenda in the investigation. There are signs that the University's approach may lean towards confirming pre-existing beliefs rather than conducting an impartial examination of facts. This perception is influenced by various factors, including the Committee's composition, their investigational approach, and the University's actions during this process.

The possibility of an outcome-driven investigation is particularly worrying in scientific research, where integrity and validity of findings are critical. Pursuing a predetermined outcome, rather than an open-minded exploration of evidence, fundamentally challenges the principles of scientific inquiry and academic integrity, especially given the high stakes for my career, reputation, and the scientific community.

Concerns about a result-oriented investigation are amplified by the University's handling of the process. The opaque formation of the Committee, the lack of members with relevant expertise in my field, and the overall management of the investigation raise questions about the University's dedication to a fair and unbiased inquiry.

This report is a sincere reflection of my efforts to protect my professional dignity and the sanctity of scientific inquiry against what I perceive as a biased and flawed investigative process. It seeks to present a comprehensive and objective analysis of the events and interactions leading to the current situation, earnestly aiming to restore fairness and truth amid significant challenges.

The purpose of this report is not only to defend my professional integrity but also to advocate for the principles of fairness, objectivity, and scientific accuracy. It is a request for reconsideration of the investigation's approach and a call for the involvement of experts with appropriate knowledge in low-temperature, high-pressure superconductivity research. Such steps are vital for the investigation to gain credibility, ensure accurate conclusions, and earn the trust of the academic and scientific communities.

I. Introduction.

A. My Journey to be a Scientist.

I, with my family, emigrated to the United States from Sri Lanka, a South Asian Island nation facing a myriad of social and economic challenges. Sri Lanka is home to a diverse population comprising various ethnicities. Periods of political instability and governance challenges have affected the country's economic progress. Income inequality is a persistent issue in Sri Lanka, with disparities between urban and rural areas and among different social groups. Access to education, healthcare, and job opportunities often varies, contributing to uneven economic development.

Growing up in a marginalized community, I faced numerous challenges that often hinder access to quality education. However, my unwavering determination and passion for learning propelled me beyond these obstacles. As a minority individual from an underprivileged background, I recognize my role as a scientist of color who has charted an extraordinary path in the field of academia, specifically in the realm of experimental condensed matter physics. My journey is a testament to resilience, perseverance, and a commitment to excellence.

My academic journey commenced with a Bachelor of Science degree in Physics from the University of Colombo, Sri Lanka, in 2006. Driven by a passion for research and exploration, I pursued a Ph.D. in Physics at Washington State University, Pullman, WA, graduating in 2013. My doctoral research focused on the collective behaviors of extended solids, covering topics such as phase transitions, metallization, superconductivity, and magnetic ordering.

Following the completion of my Ph.D., I continued my research as a Postdoctoral Researcher at Washington State University, delving into the synthesis of high-energy density materials. Subsequently, I joined Harvard University as a Postdoctoral Fellow from June 2014 to June 2017, working under the guidance of Prof. Isaac F. Silvera on "Quantum Phenomena in Hydrogens at Extreme Conditions."

In July 2017, I assumed the role of Assistant Professor at the University of Rochester, where I have been actively engaged in teaching and research. My interdisciplinary approach is evident in my dual appointments in Mechanical Engineering and Physics and Astronomy. My research interests span quantum matter under extreme conditions.

B. Teacher and Mentor to Students.

Since joining the University of Rochester in 2017, I have enjoyed consistent positive recognition from students as a teacher and mentor. Students have appreciated my organization of lectures, my understanding of material topics and my ability to relate theoretical concepts to real-life applications. Many students have highlighted my genuine and caring nature, describing me as an amazing person and a great teacher who exhibits sincere respect for students. This sentiment is especially noteworthy in comparison to experiences in other departments.

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Students have emphasized my role and my commitment to their success, citing my availability in my office, my approachability, and my willingness to help. Despite challenging exams, students appreciate the opportunities provided to deepen their understanding of the material. My engaging teaching style, evident through thoughtful questioning during lectures, has been particularly effective in capturing students' attention and fostering a positive learning environment. Overall, the students' comments reflect a consensus that I am not only a knowledgeable and dedicated instructor but also a caring mentor who significantly contributes to students' academic and personal growth in the realm of engineering.

My commitment to mentorship and teaching is evident in my extensive experience with hundreds of undergraduate students and a cohort of 20-30 mentees, including 6 PhD students. Notably, under my guidance, 2 PhD students have successfully graduated, and 4 continue their doctoral journeys under new advisors. My approach to mentoring involves providing creative freedom to my PhD students, fostering an environment conducive to innovative research expression. I try to avoid micromanagement while ensuring consistent monitoring of progress and maintaining an open-door policy for collaborative learning. Particularly noteworthy is my unique strategy of hiring around 21 undergraduate students in my lab over the past six years, offering them paid positions for research. This distinctive approach has yielded impressive results, with many of these students publishing papers, gaining admission to prestigious graduate schools, and ultimately securing well-compensated positions in the private sector. My mentorship model stands out as a successful and transformative force, contributing not only to academic achievement but also to the professional success of my mentees.

C. Managing Two Disgruntled Students.

In managing the challenges posed by two disgruntled students, namely Dylan Durkee and Ray McBride, I have endeavored to provide a comprehensive context to their concerns. Dylan Durkee voluntarily departed from my team in 2022, citing challenges that disrupted the work environment. It's noteworthy that a disagreement with Prof. Ashkan Salamat, Dylan's former instructor at UNLV, may have influenced his complaints, prompting consideration of potential bias. Dylan's negative attitude escalated following his partner's termination at Unearthly Materials, Inc., a company with which I am affiliated. Recognizing the adverse impact on the lab environment, I supported Dylan's departure and recommended his integration into Prof. Suxing Hu's group.

Similarly, Ray McBride, closely associated with Dylan, faced comparable challenges, indicating a pattern that necessitates consideration. Despite acknowledging Ray's academic struggles, including a low GPA and limited research experience, I consistently provided opportunities for improvement. Despite individual meetings and support, Ray's confrontational approach and lack of progress in his PhD research persisted.

Throughout these challenges, I have maintained an open line of communication with other professors, including Prof. John Lambropoulos and Prof. Steven Manly, and recently expressed my concerns to Jill Morris. By offering detailed insights into the unique circumstances of Dylan and Ray, I aim to present a thorough perspective for a fair and impartial assessment of their involvement in the ongoing investigation.

II. Background Information.

The intricate interplay between Unearthly Materials, Inc. and intellectual property rights is not only a matter of business and legal frameworks but has emerged as a critical focal point in the ongoing investigation, particularly concerning its potential adverse impact on me in what now appears to be a biased outcome driven result-oriented investigation. The strategic termination of Dr. Salamat from Unearthly and subsequent retaliatory actions reveals a complex web of personal and professional dynamics that may be influencing the investigation's trajectory. The licensing agreements with the University of Rochester, designed to protect intellectual property, have taken an unexpected turn, suggesting motives that could disadvantage me. Understanding these events is crucial for unraveling potential biases among witnesses and comprehending the University of Rochester's motivations, both of which may contribute to an investigation that appears prejudicial and outcome driven.

A. Unearthly Materials, Inc.

To provide context for the current investigation and the people behind the scenes that are driving various retractions of co-authored papers that are the subject of the investigation, it is important to understand my business relationship with Unearthly Materials, Inc. Unearthly Materials, Inc. was founded by me and Ashkan Salamat. The genesis of Unearthly Materials, Inc. was marked by a shared commitment to pushing the limits of materials science for the betterment of society. We recognized the potential impact of our collaborative efforts on fields ranging from energy storage and electronics to aerospace and healthcare. This shared vision laid the groundwork for a company culture that thrived on curiosity, creativity, and a determination to solve some of the most pressing challenges facing humanity. Unearthly Materials, Inc. entered into licensing agreements with the University of Rochester for various intellectual property considerations arising from the scientific work being done at Unearthly Materials, Inc.

Together, Dr. Salamat and I co-authored several papers, some of which are the subject of the current investigation. As co-authors, we were committed to transparency in publishing while preserving proprietary intellectual property considerations for Unearthly and for the University of Rochester vis-à-vis the licensing agreements. Preserving intellectual property rights is of paramount importance, particularly in the realm of scientific discoveries, where innovation and groundbreaking research play a pivotal role in advancing society. In the case of Unearthly and its collaboration with the University of Rochester, the significance of safeguarding intellectual property rights cannot be overstated.

Licensing agreements between Unearthly Materials, Inc. and the University of Rochester underscore the need for a robust framework to protect the intellectual property arising from their collaborative efforts. These agreements serve as a cornerstone for fostering innovation by providing a structured mechanism for the commercialization of scientific discoveries. Preserving intellectual property rights ensures that the fruits of extensive research and development efforts can be properly attributed, incentivizing continued investment in groundbreaking projects. It also enables Unearthly Materials, Inc. to maintain a competitive edge in the market, as exclusive rights to the intellectual property resulting from their collaboration allow for strategic decision-making and control over the commercialization process.

Moreover, the preservation of intellectual property rights in scientific discoveries facilitates the dissemination of knowledge while providing a framework for fair and equitable partnerships. It encourages collaboration between academia and industry by establishing clear guidelines for the use and exploitation of innovative technologies. In the case of Unearthly Materials, Inc. and the University of Rochester, the licensing agreements not only protect the interests of both parties but also contribute to the broader scientific community by creating a sustainable model for translating research findings into real-world applications.

Regrettably, mid last year, I made the strategic decision to terminate Dr. Ashkan Salamat's role as Chief Executive Officer and board member of Unearthly Materials, Inc. based on a thorough assessment of various business financial considerations that required immediate attention. This decision, driven by the need to address critical financial aspects of the company, resulted in Dr. Salamat's disengagement from the operational aspects of Unearthly Materials, Inc. Subsequently, Dr. Salamat has been actively pursuing the retraction of all collaborative research papers authored during our association over the past several years, including those currently under investigation.

In response to this professional separation, Dr. Salamat has expressed his discontent by swearing vengeance against me. Presently, he is actively pursuing and implementing actions to exact this vengeance, actively garnering support from his former students in this endeavor. Dr. Salamat's involvement in soliciting retractions extends to influencing former students who collaborated on these papers to participate in the retraction requests. Consequently, numerous papers are in the process of being retracted, or are likely to face retraction, solely due to the requests made by co-authors who now oppose me based on the termination of the business association with Dr. Salamat through Unearthly Materials, Inc.

The revelation of Dr. Salamat's retaliatory actions following his termination as CEO and board member of Unearthly Materials, Inc. underscores the importance of sharing this information to shed light on potential biases among the witnesses relied upon by the Investigation Committee. The active involvement of Dr. Salamat in orchestrating the retraction of collaborative research papers, coupled with his influence over former students, introduces a concerning element of personal vendetta into the proceedings. It is crucial for the Investigation Committee to acknowledge and critically evaluate the motivations behind the witnesses' actions, recognizing the potential for bias arising from personal grievances. This information not only highlights the complexity of interpersonal dynamics within scientific collaborations but also emphasizes the need for a discerning and impartial assessment of the evidence presented. A critical examination of the motives behind witness testimonies is imperative to ensure the integrity and objectivity of the Investigation Committee's findings, fostering a fair and comprehensive understanding of the situation at hand.

Regrettably, it is concerning to observe that in its assessment, the Investigation Committee may have not fully addressed the critical aspect of evaluating bias among witnesses, especially regarding the actions of Dr. Salamat, which could be perceived as retaliatory. Rather than independently and thoroughly analyzing the statements of witnesses, the Committee appears to have placed considerable reliance on these testimonies without fully considering possible personal motivations that might have influenced the witnesses' views. This lack of in-depth scrutiny into

potential witness bias calls into question the objectivity and thoroughness of the Committee's investigative process. To ensure a fair and unbiased evaluation, it is essential for the Committee to reexamine its methods, adopting a more analytical approach and conducting an independent review of witness statements. This would enable a more accurate understanding of the situation and lead to well-informed conclusions.

The impact of the Committee's reliance on potentially biased witnesses is further highlighted by a series of scientific inaccuracies present in their findings. These inaccuracies will be meticulously addressed in a forthcoming response to the Committee's conclusions. This response aims to provide a comprehensive analysis of the scientific errors that have emerged from depending on biased testimonies, thereby clarifying the actual scientific facts of the case.

B. Intellectual Property Rights.

In a situation that presents some contradictions, the University of Rochester, while appearing to distance itself from me publicly, seems to be subtly engaging in actions to leverage the intellectual property rights related to my significant scientific contributions. The licensing agreements established between Unearthly Materials, Inc. and the University of Rochester, which are ostensibly in place to safeguard intellectual property, might unintentionally offer the university a strategic advantage in harnessing the commercial value of my research.

Despite the University of Rochester's visible efforts to dissociate from me, it is a matter of concern that the management of intellectual property rights might be utilized as a means for the university to assert influence over the commercial applications of my discoveries. This approach might be interpreted as an attempt to exclude me from the rightful benefits of my research, while simultaneously using the licensing agreements to further the university's interests in both scientific and commercial spheres. This dual strategy of publicly distancing while privately seeking to benefit from my work raises questions about the university's ethical practices and potential conflicts of interest, particularly in the context of what seems to be an investigation driven by specific outcomes and results, potentially biased and prejudicial.

III. National Science Foundation Policy Requirements.

A. March 16, 2023 Referral Letter.

"Because a professional reputation is involved, fairness, due process, and confidentiality should be considered paramount. There is no presumption of wrongdoing by Dr. Dias or anyone else associated with the alleged research misconduct; rather, your confidential investigation should be designed to determine, without preconceptions, whether research misconduct occurred, and if so, who committed it." (Page 1)

This is the directive from the NSF regarding the investigation in question. Unfortunately, this directive has not been followed by the University and/or the Investigation Committee assembled by the University.

B. Title 45 Subtitle B Chapter VI Part 689.
§ 689.1 Definitions.
The following definitions apply to this part:

(a) ***Research misconduct*** means fabrication, falsification, or plagiarism in proposing or performing research funded by NSF, reviewing research proposals submitted to NSF, or in reporting research results funded by NSF.

(1) ***Fabrication*** means making up data or results and recording or reporting them.

(2) ***Falsification*** means manipulating research materials, equipment, or processes, or changing or omitting data or results such that the research is not accurately represented in the research record.

(3) ***Plagiarism*** means the appropriation of another person's ideas, processes, results or words without giving appropriate credit.

(4) ***Research,*** for purposes of paragraph (a) of this section, includes proposals submitted to NSF in all fields of science, engineering, mathematics, and education and results from such proposals.

(b) ***Research misconduct*** does not include honest error or differences of opinion.

IV. University of Rochester Policy Requirements.

Relevant provisions of the University of Rochester Policy on Research Misconduct expressly provide as follows:

> "… It describes a process for an objective examination of the facts, protection of individual rights, and integration with other relevant review procedures, all under the general supervision of the Provost…" (Introduction, second para.)
>
> "… Reasonable efforts shall be made to ensure an impartial and unbiased investigation to the maximum extent possible; no individual who has an unresolved personal, professional or financial conflict of interest with the person whose conduct is being investigated (the respondent), the person(s) making the allegations (the complainant(s)), or any witnesses should participate in the proceedings." (Introduction, last para.)
>
> "(3) The respondent will be given a written copy of all allegations that are the subject of the investigation and the opportunity to appear before the committee to respond to the allegations." (Investigation, para. (3))
>
> "Comments submitted by the respondent or complainant(s) shall be considered in preparing the final report and included in the report. (Investigation, para. (4))

Unfortunately, the ongoing investigation under the supervision of the provost seems to diverge from the University's policy requirements for an "objective examination" to be carried out with impartiality and without bias. Certain actions taken by university officials involved in the investigation have led to concerns about the integrity of the process. Notably, the provost, who is responsible for overseeing the investigation, has been involved in decisions to relocate all my students from my laboratory and classroom during the investigation. This move suggests a presumption of wrongdoing and appears to communicate such a presumption to witnesses involved in the investigation.

After I submitted a formal grievance to the University, it became apparent that the provost played a part in fostering a narrative implying that the students had voluntarily requested to be removed from my laboratory and classroom. This was contradicted by affidavits from multiple students, who attested under penalty of perjury that they did not request such removal but were instead informed by the University about this decision. Following the initiation of legal action against the University, it was acknowledged that I was entitled to a grievance committee, considering the University's unilateral actions impacting the investigation.

In summary, University officials, particularly those linked to the Investigation Committee, took actions against my students and potential witnesses both during and prior to the investigation's conclusion. These actions seem to have been designed to create an impression of wrongdoing. Furthermore, the University and officials cooperating with the Investigation Committee, including the provost overseeing the investigation, have advanced a narrative against me, which appears aimed at justifying their decision to relocate the students and to influence the investigation in a biased manner. Such actions are in conflict with the stated policies of the University.

V. The Investigation Committee.

This section thoughtfully discusses the critical importance of having a conflict-free, neutral, and unbiased investigation committee in upholding the integrity of evaluations in scientific research. The impartiality of committee members is especially crucial in the investigation of complex and specialized fields, such as low-temperature high-pressure superconductivity. Ideally, such a committee should consist of individuals deeply knowledgeable about the topic, with expertise closely aligned with the specific nuances of the research being examined. However, there is a concern regarding the composition of the current Investigation Committee appointed by the University.

The Committee is chaired by Dr. Marius Millot and includes members Dr. Peter Celliers and Dr. Marcus Knudsen. While these individuals are esteemed shock physicists with notable credentials in high-energy density physics, their primary focus on shock physics prompts questions about their ability to effectively evaluate research in the distinct field of low-temperature, high-pressure superconductivity. This divergence in expertise, which is elaborated upon in response to the numerous errors in the Committee's conclusions, suggests a possible limitation in the Committee's capacity to conduct a fully informed and impartial investigation.

A. Composition of Investigation Committee.

The Investigation Committee is chaired by Dr. Marius Millot, a Senior Scientist at the Lawrence Livermore National Laboratory. Other members include Dr. Peter Celliers, a Staff Scientist at the Lawrence Livermore National Laboratory (LLNL), and Dr. Marcus Knudsen, a Senior Scientist at Sandia National Laboratories. All three members of the Committee are recognized for their contributions to high-energy density physics and material dynamics under extreme pressure and temperature, with a particular focus on shock physics, which is a subfield of high-energy density physics.

Shock physics primarily investigates the dynamic compression of materials under extreme conditions, often through the study of shock waves or laser shock. The field primarily aims to understand the structural changes and material properties at extreme pressures and temperatures. While shock physics provides valuable insights into material behavior under these conditions, it differs from low-temperature, high-pressure superconductivity research both in its subject matter and in the analytical approaches it employs. Experts in shock physics, such as the Committee members, typically adopt a broader perspective in analyzing experimental data. Their focus is often on understanding the immediate structural changes and material properties under extreme, rapid compression.

In contrast, low-temperature, high-pressure superconductivity research demands a more focused and detailed analysis of experimental data, centering on the subtle nuances of the superconducting transition. This field involves a thorough examination of specific data points related to electrical conductivity, magnetic susceptibility, and other properties pertinent to superconductivity. The research aims to uncover the underlying mechanisms, materials, and phase transitions that facilitate superconductivity under unique conditions, necessitating a deep and meticulous approach to data interpretation.

Furthermore, the experimental techniques used in shock physics research, such as high-velocity impact experiments, laser-driven shock experiments, and the use of gas gun facilities, differ significantly from those employed in low-temperature, high-pressure superconductivity studies. Diagnostic methods like high-speed imaging and spectroscopy are crucial in shock physics for analyzing material responses under dynamic conditions, often supported by advanced tools like high-powered lasers.

Conversely, the study of superconductivity, characterized by zero electrical resistance, primarily occurs at low temperatures. The intersection of low temperatures with high pressure presents an intriguing and complex area of research in physics. Low-temperature, high-pressure superconductivity researchers aim to identify new superconductors, understand how low temperatures and high pressures alter material properties, and explore potential applications in various fields, including quantum computing, energy transmission, transportation, and other transformative technologies. This specialization calls for a distinct set of skills and knowledge, emphasizing the need for expertise specifically aligned with the requirements of low-temperature, high-pressure superconductivity research.

To study low-temperature, high-pressure superconductivity, researchers utilize advanced experimental setups. Techniques such as diamond anvil cells, capable of generating high pressures, are employed. Measurements of electrical conductivity, magnetic susceptibility, and other relevant properties are conducted under these extreme conditions. State-of-the-art spectroscopy and imaging tools assist in analyzing material behaviors.

Comparing and contrasting experience in shock physics with experience in high pressure low temperature superconductivity research reveals the following significant differences:

- Shock physics centers on dynamic compression and material responses under intense pressures and high temperatures, while low-temperature, high-pressure superconductivity research explores the competing quantum effects at low temperatures and high pressure.

- Shock physics primarily deals with rapid and intense pressure and temperature changes, whereas low-temperature, high-pressure superconductivity research involves sustained low temperatures and high pressures. It's about dynamic compression (occurring on a very short time scale) vs static compression (occurring on a very long time scale).

- Shock physics findings contribute to planetary science, defense and national security, Earth sciences, and materials properties at high pressures while low-temperature, high-pressure superconductivity research has applications in quantum computing, energy transmission, quantum information science and quantum materials.

I respectfully highlight these distinctions to emphasize that while physicists may be experts in their own domains, the specific nature of both shock physics and high-pressure, low-temperature superconductivity research requires unique sets of knowledge and skills. A physicist specialized in shock physics might have a deep understanding of material behavior under dynamic compression and the creation of shock waves in extreme conditions. However, exploring the complex world of low-temperature, high-pressure superconductivity involves a detailed knowledge of condensed matter physics, quantum mechanics, and the effects of combining prolonged low temperatures with high pressures. The particular phenomena of superconductivity and the specialized experimental techniques used in this research area necessitate expertise in that specific subfield. Therefore, it's essential for interdisciplinary collaborations and peer reviews to include experts who are equipped with the specialized knowledge needed for a comprehensive evaluation and interpretation of research data in the field of high-pressure, low-temperature superconductivity.

When considering these factors, the limitations become more apparent if a physicist with a background in shock physics does not have direct experience in the critical experimental methods crucial for assessing high-pressure, low-temperature superconductivity research. The complexities of this specialized area involve detailed measurements of heat capacity, magnetic susceptibility, electrical resistance, and the phenomena of superconductivity. Lacking experience in conducting these types of experiments might pose a challenge for a reviewer in fully understanding the subtle intricacies and interpreting the importance of experimental findings. Not having hands-on experience in such key measurements could impede the reviewer's capacity to provide a thorough and knowledgeable evaluation, highlighting the significance of involving experts who have direct

experimental expertise in the specific techniques used in high-pressure, low-temperature superconductivity research. Interdisciplinary collaborations that unite researchers with diverse skills are pivotal for ensuring a holistic and accurate assessment of research data and findings in this complex and specialized field.

The current Investigation Committee displays a significant difference in experience, especially when comparing their expertise in shock physics to their relatively limited familiarity with experimental research in high-pressure, low-temperature superconductivity. This noticeable difference in expertise is respectfully highlighted by the errors and shortcomings apparent in the Committee's analyses of various aspects of the experimental research they are reviewing. The errors and incorrect conclusions made by the Investigation Committee will be respectfully addressed in greater detail in a direct response to their numerous incorrect allegations.

B. The Investigation Committee’s Conflicts of Interest.

Scientific investigation committees are integral to maintaining the integrity of research and upholding high standards of ethical conduct. However, conflicts of interest within these committees can potentially affect the impartiality and fairness of their deliberations. Conflicts of interest in a scientific investigation committee may occur when members have employer-employee relationships, share extensive publication collaborations with each other or with an investigative body such as a university, or when university personnel involved in the committee interfere with student witnesses. Other conflicts can arise when university staff working with the committee take actions harmful to the subject of the investigation, or when the subject of the investigation is viewed as a competitor by the committee members.

The presence of conflicts of interest in a scientific investigation committee carries significant ethical implications. Adhering to the principles of fairness, objectivity, and transparency is crucial to preserve the credibility of scientific inquiry. When the integrity of a committee is compromised, it not only undermines trust within the scientific community but also raises concerns about the underlying motivations of the investigation. In this context, we highlight instances that have occurred during the investigation, revealing unprecedented conflicts of interest among committee members and extraordinary actions by university personnel and the university attorney working in close association with the Investigation Committee.

1. Shared Employer-Employee Relationships on the Committee.

The conflicts of interest present in this scenario are complex and cast doubt on the Investigation Committee's ability to conduct a fair and impartial investigation. A significant conflict arises from the fact that two of the three members of the Investigation Committee are employed by the same institution. This shared employer-employee relationship may lead to a loyalty bias, potentially impacting the Committee's findings and compromising its independence, neutrality, and objectivity.

Dr. Marius Millot, chair of the Investigation Committee, serves as a Senior Scientist at the Lawrence Livermore National Laboratory (LLNL), while his colleague and more senior member of the same team, Dr. Peter Celliers, is a Staff Scientist at LLNL. Their roles at LLNL are not only

within the same employer but also within the same Physics Division, sharing professional interests in laser research. The professional dynamics between Senior and Staff Scientists often mirror the hierarchical structures within an organization, influencing the distribution of responsibilities and authority.

More senior scientists generally hold decision-making power regarding project assignments and resource allocation. They are instrumental in assigning junior scientists to projects, considering their skills, experience, and the project's needs. In this capacity, senior scientists guide less senior scientists' project involvement, offering mentorship and direction. They also play a crucial role in evaluating the performance of less senior scientists, influencing career progression, promotions, and recognition within the institution. A senior scientist's recommendations can be pivotal for a less senior scientist's promotion, assignment to new responsibilities, or leadership opportunities. Additionally, more senior scientists typically have access to a wider network of professional contacts, collaborations, and funding sources, which they can utilize to support the career growth of less senior scientists by including them in high-profile projects or introducing them to key figures in the field.

In this context, Dr. Peter Celliers, as a more senior scientist at LLNL, holds a considerable degree of authority and influence over his colleagues, including Dr. Marius Millot. This dynamic is critical when considering the structure of the Investigation Committee, where Dr. Millot serves as the chair and Dr. Celliers as a member. The hierarchical relationship between them at LLNL, with Dr. Millot in a position subordinate to Dr. Celliers, creates a challenging situation for maintaining the required independence, objectivity, and neutrality essential for a fair and balanced impartial scientific investigation. This situation represents a conflict of interest that poses significant challenges to the Committee's ability to conduct an unbiased review. In the current circumstances of the impact of this investigation, I respectfully note that this is an untenable conflict of interest that cannot be waived.

2. Shared Publications Between Committee Members.

Recognizing conflicts of interest is vital in preserving the integrity and impartiality of any investigative process, particularly when it involves committee members who are tasked with evaluating significant issues. A notable conflict that requires careful examination is the shared history of publications among committee members. Collaborative efforts on academic papers can create strong personal and professional bonds, which might inadvertently affect the objectivity of the committee. There is a risk that members may unconsciously favor shared viewpoints or preconceived notions, thus impacting the fairness of their assessment.

This concern is heightened by a notable record of joint authorship, as seen in the extensive collaboration between Dr. Marius Millot and Dr. Peter Celliers. From 2011 to 2023, Dr. Marius Millot and Dr. Peter Celliers have co-authored nearly 60 publications, as detailed in Appendix III. Such a prolific co-authorship history could, by itself, represent a significant conflict of interest, given the depth of the personal and professional relationship that arises from extensive collaboration. When combined with their mutual employment and hierarchical working relationship, the conflicts of interest become even more pronounced. In recent years, Dr. Marius

Millot, Dr. Peter Celliers, and Dr. Marcus Knudsen, who together constitute the Investigation Committee, have co-authored at least two recent publications, as shown in Appendix III.

From 2015 to 2023, Investigation Committee members Dr. Marius Millot and Dr. Peter Celliers have co-authored at least 28 publications with members of the University of Rochester, including my professional colleagues, as outlined in Appendix III.

Given the complex nature of the publication relationships among the Investigation Committee members, the conflicts of interest identified are significant and cannot be overlooked. The extensive history of collaboration, both between Dr. Marius Millot and Dr. Peter Celliers and collectively with colleagues at the target institution, suggests a level of interconnectedness that could compromise the essential impartiality required for a fair investigation. Considering these findings, it is crucial to contemplate a restructuring of the Investigation Committee. Recognizing the challenges posed by the deep relationships among its members is important. To maintain objectivity and fairness, a re-evaluation of the Committee's composition might be necessary, potentially including recusals or the addition of independent experts. Such steps would be instrumental in restoring trust and ensuring an unbiased evaluation of the matter under investigation.

3. The Target Being a Competitor of Members of the Investigation Committee.

The potential for conflicts of interest becomes more marked in situations where the scientist being investigated is a competitor of the Committee members. The competitive nature of this relationship might introduce an element of rivalry, which could affect the Committee's ability to impartially assess the scientific work of their competitor. There is a risk that personal biases or professional envy might unconsciously influence the Committee's judgments, potentially leading to a biased investigation.

A significant concern arises from the longstanding competitive dynamic between myself and the members of the Committee: Dr. Marius Millot, Dr. Peter Celliers, and Dr. Marcus Knudsen. This rivalry dates back to my postdoctoral years at the Department of Physics at Harvard University and centers on research into metallic hydrogen in both solid and liquid states, particularly focusing on demonstrating superconductivity in solid-state hydrogen.

My research has predominantly involved static compression techniques, differing from the dynamic compression methods used by the research groups of Dr. Millot, Dr. Celliers, and Dr. Knudsen. Notably, Dr. Millot and my academic advisor, Professor Silvera, have had several disagreements, even public disputes, during conferences over the interpretation of research data.

Regrettably, this competitive history includes instances where my work, as well as Professor Silvera's, was not acknowledged in research papers authored by these investigators. While I acknowledge that this has not been the case for every publication, it has occurred frequently enough to raise concerns about a possible bias against recognizing my scientific contributions. This history of competition and differing research methodologies underscores the need for careful consideration of potential conflicts of interest within the Investigation Committee.

a. The Introduction of Unfounded Accusations Not Related to My Publications.

An instance where this bias was evident occurred during an interrogation session led by Dr. Marius Millot. In this session, Dr. Millot raised an accusation of "self-plagiarism" pertaining to publications authored by Prof. Silvera's during my postdoctoral tenure. It is important to note that these publications were authored by Prof. Silvera and were not pertinent to the scope of the NSF-referred investigation, nor were they related to any NSF funding I had received. This incident, however, highlighted a tendency in Dr. Millot to seek out potential misconduct, even in areas unrelated to the central focus of the investigation.

b. The Inappropriate Demand for My Unpublished Manuscript of Proprietary Work.

In a separate session, Dr. Marius Millot requested access to a manuscript concerning a study of graphene under pressure. This study falls outside the scope of the investigation and contains proprietary information. Additionally, this work has not yet been published. My decision not to disclose this ongoing research was met with apparent disregard for the proprietary nature of my work. This incident raises concerns about the potential for retaliatory actions by the Investigation Committee, particularly under the chairmanship of Dr. Marius Millot.

c. The Personal Relationship Between My Former Business Partner and Dr. Marius Millot.

It is important to acknowledge that Dr. Marius Millot maintains a personal relationship with Professor Ashkan Salamat, who was previously my collaborator and business partner. It is pertinent to note that Professor Salamat and I have concluded our professional business association, and he is no longer involved in supporting my work. The significance of this connection becomes more pronounced considering Dr. Millot's role as the chair of the Investigation Committee, leading to questions about how his personal relationship with Prof. Salamat might influence his approach to the investigation.

In addition, Dr. Millot has familial connections to Dr. Aude Pickard, the former partner of my co-author and past business associate. Dr. Pickard is also a close friend of Dr. Millot's wife. This network of personal relationships adds an additional layer of concern regarding potential biases that may affect Dr. Millot's ability to remain impartial in his capacity as the chair of the Investigation Committee.

To provide context to their personal relationship, it is notable that Dr. Millot and his wife have visited Professor Salamat's residence in Las Vegas for social purposes. One instance of such a visit was during the 2021 California wildfires when they stayed at Professor Salamat's home. This demonstrates the depth of the personal connection between Dr. Millot and Professor Salamat.

d. Dr. Marius Millot's Engagement with Professor Jorge Hirsch's Criticisms of our Work.

Additionally, I have information indicating that Dr. Marius Millot was actively following Professor Jorge Hirsch's critiques of our work. Reportedly, during his stay at Professor Salamat's house during the California wildfires, Dr. Millot engaged in discussions that supported Prof. Hirsch's criticisms on various social media platforms.

In summary, the composition of the Investigation Committee gives rise to significant concerns about its independence. I have communicated these concerns to Prof. Stephen Dewhurst during a Zoom call, where he expressed regret for not conducting thorough due diligence prior to the formation of the Committee. However, as of now, no remedial actions have been taken. The professional relationships, affiliations, and previous interactions among members of the Investigation Committee, along with instances of demonstrated bias, suggest a compromised level of impartiality that could impact the integrity of the investigation. To maintain fairness and objectivity, further examination and actions to ensure an unbiased Investigation Committee are essential in addressing these issues. In light of these considerations, it would be advisable to reconstitute the Investigation Committee with physicists who possess proven expertise in low-temperature, high-pressure superconductivity research and the associated experimental techniques.

VI. The University of Rochester's Influence in the Investigation and Its Impact on the Process

In response to claims of research misconduct, the University of Rochester initiated an investigation by establishing an Investigation Committee composed of three scientists. This process is intended to maintain impartiality, objectivity, and fairness in evaluating my research. Nonetheless, recent actions by university administrators, including Dean Wendi Heinzelman and Investigation Committee liaison Stephen Dewhurst, have raised significant concerns about their influence on the ongoing investigation. The decision to remove all of my students from my laboratory and teaching roles during the investigation has not only disrupted established professional dynamics but also appears to contravene the principles of due process. Such a unilateral measure prematurely suggests wrongdoing and has weakened confidence in the integrity of the investigation.

Furthermore, the interactions between University liaison Stephen Dewhurst, University attorney Leslie Thornton, and witnesses concerning the retraction of a paper which is the subject of the investigation have introduced elements of conflict of interest and bias, detracting from the objectivity of the investigation. Additionally, the issue of providing contracts and financial compensation to a key witness, Dr. Sachith Dissanayake, poses questions of potential bias and conflict of interest, thereby compromising the credibility of the investigation.

It is imperative that the University and its administrators avoid any actions that could be perceived as interfering with the investigation. Allowing the external Investigation Committee to function independently and objectively is essential for ensuring a fair and unbiased outcome. Addressing these concerns is critical to upholding the standards of fairness, objectivity, and integrity in academic investigations.

A. The Committee's and the University's Premature and Unilateral Action: Students Removed from My Lab and Teaching, Advising and Mentoring During the Ongoing Investigation.

On August 3, 2023, University of Rochester Dean Wendi Heinzelman, in coordination with Stephen Dewhurst, who serves as the University of Rochester liaison for the Investigation Committee, unilaterally decided, without any prior discussion with me, to remove all of my undergraduate and graduate students from my laboratory and from my teaching, mentoring, and advising responsibilities. Despite claims by Dean Heinzelman, Stephen Dewhurst, and the University that the students had requested this reassignment, relevant emails from Dean Heinzelman to me, correspondence from the students, and sworn affidavits from the students indicate that they did not initiate this request. Instead, it appears that the University, amidst the ongoing investigation, chose to remove the students without my involvement. This action seems to have been taken to bias the students against me and create an impression of guilt before the conclusion of the ongoing investigation. The administrators at the University, including Stephen Dewhurst as the liaison to the Investigation Committee, have collectively contributed to a biased, prejudiced, and seemingly outcome-driven investigation through their actions.

Furthermore, the University's unilateral decision to reassign students from my lab and classroom during an active investigation has introduced a troubling element, disrupting established professional relationships and denying me a basic level of fundamental due process within the framework of the ongoing investigation.

1. Disruption of Professional Relationships.

The University's unilateral decision to remove students from my lab and classroom significantly disrupted the established professional relationships I had with my students. This action likely led the students to perceive a lack of support for me as their mentor, potentially straining our relationships and affecting my future ability to mentor and teach effectively.

2. Undermining Due Process.

The removal of students from my teaching, mentoring, and advising roles before the completion of a thorough investigation has undermined the principles of due process. This action conveyed a message that the University had prematurely reached conclusions about my conduct, without allowing me the opportunity to respond to the allegations or defend myself.

3. Unfair Appearance and Stigmatization.

This unilateral action created an unfair perception within the University and among the members of the Investigation Committee that I was guilty before being proven innocent. This perception has led to a stigmatization of me not only within the University community but also in the eyes of the Investigation Committee, thereby compromising any chance of a neutral, fair, or objective investigation.

4. Erosion of Trust.

Trust, which is essential in any academic investigation, has been eroded by actions that jeopardize the independence of the Investigation Committee. The unilateral decision by the University Dean, in collaboration with the University Liaison to the Investigation Committee, to remove my students, has raised concerns about the Committee's ability to function independently. This action suggests potential conflicts of interest, undue influence driven by the University's desired outcomes, and a lack of adherence to the due process that should have been afforded to me, without a presumption of guilt stemming from the removal of my teaching, advising, and mentoring responsibilities.

The unilateral actions taken against me have cast a shadow over the ongoing investigation, suggesting a biased approach. The conduct of the university administrators, including the liaison to the Investigation Committee, has compromised the principles of objectivity, fairness, and due process. These actions have eroded trust in the Investigation Committee's capacity to carry out an impartial and unbiased inquiry. I have been subjected to an investigation process that is both unfair and biased. The negative consequences arising from these unilateral actions need to be duly acknowledged and rectified to restore the integrity of the investigative process.

B. The University's Impropriety: University Administrator and University Attorney Collaboration in the Retraction Request of Professor Dias's Paper During the Ongoing Investigation.

The essence of scientific inquiry is the pursuit of truth and objectivity. However, concerns about impropriety, conflicts of interest, and potential bias arise when individuals in positions of authority, such as university administrators and attorneys, collaborate behind the scenes to influence outcomes, such as the retraction of a paper authored by a scientist under investigation.

During the current investigation, Stephen Dewhurst, the University liaison for the Investigation Committee, and Leslie Thornton, the University attorney assisting the Committee, began collaborating with witnesses to draft a letter to the editors at Nature, requesting the retraction of a paper that I, as the subject of the ongoing investigation, co-authored. This collaboration among Stephen Dewhurst, Leslie Thornton, and witnesses in the investigation process introduces numerous conflicts of interest and related ethical concerns, challenging the validity of the investigation.

As the University liaison to the Investigation Committee, Stephen Dewhurst is expected to maintain a neutral and impartial position. However, his collaboration with the University attorney, Leslie Thornton, and then jointly working with witnesses in the investigation, creates multiple layers of conflict. The potential conflict between the university's legal interests and the objective pursuit of truth undermines the integrity of the investigation.

1. Prejudice and Bias.

Specifically, the collaboration between Stephen Dewhurst, Leslie Thornton, and witnesses to influence the retraction of a paper under investigation introduces a marked element of prejudice

and bias. Their efforts to discredit my scientific work before the conclusion of the investigation clearly indicate a bias against me, aligning with the University's desired outcome. Such a prejudicial approach compromises the essential principles of objectivity and fairness needed for a thorough and impartial investigation.

2. Adverse Impacts on the Investigation:

a. Undermining Credibility:

The collaboration between Stephen Dewhurst, Leslie Thornton, and witnesses to request the retraction of the Nature paper casts doubts on the credibility of the investigation. It indicates a bias against me, raising concerns about the ability of the Investigation Committee to carry out a fair and unbiased inquiry.

b. Compromising Objectivity:

The collaboration of Stephen Dewhurst, Leslie Thornton, and witnesses in efforts to retract the Nature paper compromises the objectivity of the Investigation Committee. This joint action suggests that the Committee may be influenced, making the investigative process vulnerable to external interests.

The collaboration between a university administrator and a university attorney to request the retraction of a paper I authored is highly concerning. It introduces conflicts of interest, prejudice, and bias into the investigative process, thereby undermining the credibility of the ongoing inquiry. Upholding the principles of fairness and objectivity is crucial, and this may require measures such as independent oversight, transparency, and the safeguarding of academic freedom. Addressing these issues is essential for a just and unbiased conclusion to the investigation and for maintaining the integrity of scientific inquiry within academic institutions.

C. The University Providing Contracts and Financial Remuneration to Key Witnesses.

Around August 10, 2023, Dr. Sachith Dissanayake, who was a Research Assistant Professor in my research group in the Department of Mechanical Engineering at the University of Rochester, decided to terminate the contractual agreement we had. This contract, which started on July 14, 2023, and was set to conclude on July 13, 2025, was funded through grant financing.

I later learned that Dr. Dissanayake's decision to end our contract seemed influenced by the University of Rochester offering him a separate contract, including direct remuneration from the University itself. Following this development, I became aware of Dr. Dissanayake's involvement in activities that seemed to counteract my ongoing work. Given these events, it appears plausible that his actions were swayed by the terms of his new contract with the University of Rochester, which involves direct financial compensation.

The timing of Dr. Dissanayake's new contract with the University of Rochester and his subsequent termination of our contract raises concerns over potential impropriety. This situation, where he ended our agreement shortly after receiving an alternative offer from the University, could be

perceived as a conflict of interest or indicative of bias. The alignment of this significant change in Dr. Dissanayake's employment with efforts that seem to undermine my work naturally leads to questions about the integrity of the academic and professional relationships involved. Clarity and openness in these matters are vital to uphold trust and credibility in academic settings and research activities.

It is important to note that after Leslie Thornton finalized the letter intended for Nature, Dr. Dissanayake independently approached one of my students, Sasanka Munasinghe, to sign the letter, giving him only one day to decide. This action clearly indicates that the decision was made without comprehensive discussion among all involved parties.

In his interaction with Sasanka Munasinghe, Dr. Dissanayake stated that the letter had been prepared by the University of Rochester's legal counsel, suggesting it was appropriate for him to sign. In this scenario, Dr. Dissanayake used the University's legal counsel and Stephen Dewhurst as leverage to influence and pressure Sasanka Munasinghe to sign. This example is indicative of a broader pattern, leading to the concern that similar tactics might have been used with other individuals involved in the situation.

VII. Critical Omissions by the Investigation Committee.

The Investigation Committee, appointed to assess my conduct, has encountered several significant shortcomings, leading to concerns about the fairness and objectivity of their process. Firstly, the Committee has not effectively identified, reviewed, or understood key data files from my laboratory, computer, and data files, all of which were available to them.

Secondly, the Committee's failure to interview graduate and undergraduate students from my group, who have a comprehensive understanding of the techniques used, is a glaring omission. Notably, the Committee chose not to interview Nugzari Khalvashi-Sutter and Sasanka Munasinghe. Their exclusion from the process raises questions about the thoroughness and fairness of the Committee's investigation. The non-involvement of these students in the letter drafted and sent by the University of Rochester's administrator and legal counsel, in concert with various student witnesses to Nature, further underscores actual biases and conflicts of interest within the Committee's proceedings.

Thirdly, there is either a significant misunderstanding or a deliberate disregard for the crucial experimental procedures, data, and analysis fundamental to high-pressure superconductivity experiments. This suggests a predetermined and biased intent to establish guilt on my part.

Fourthly, the Committee's reliance on interpretations by students with limited understanding of the science of superconductivity regarding experimental data undermines the credibility of the Committee’s findings. This raises questions about the objectivity and depth of their investigation.

Additionally, despite preliminary discussions about general research practices in my group, the Committee did not engage in meaningful, non-accusatory direct dialogue with me to address specific concerns related to the studies under investigation. This lack of communication highlights a deficiency in the thoroughness of the investigative process.

Moreover, the Committee's dismissal of recorded data in the available files represents a negligent approach to data analysis, with severe implications for my career. The lack of diligence in handling evidence raises concerns about the integrity of the Committee's findings.

The Committee's baseless and speculative assertion that I resampled the 20 kbar data without substantive evidence is troubling. Accusations of data falsification or fabrication should be substantiated with concrete proof, and the Committee's apparent inability to comprehend the data and its analysis casts doubt on the reliability of their conclusions.

Crucially, the Committee's interpretation of data and analysis has led to an unsupported conclusion of widespread data falsification within the realm of high-pressure superconductivity work, extending beyond my scope of work. This indicates a significant bias in the Committee’s approach.

VIII. The Investigation Committee's Assumed Misconduct and Confrontational Approach.

The methodology employed by the Investigation Committee during interviews is a critical aspect that warrants scrutiny. Unfortunately, their approach markedly deviated from the expected standards of objectivity, fairness, and impartiality. Instead of adopting an inquisitive and neutral demeanor to gain a comprehensive understanding of the research, the Committee’s approach seemed overly aggressive, confrontational, and notably biased against me. As a native of Sri Lanka, I sometimes face difficulties in fully comprehending the subtleties of the English language and often require more time for processing information in a supportive environment.

The assertive way the interviews were conducted gave me the impression that the Investigation Committee had a preconceived notion of guilt from the beginning. This perceived approach not only strays from the essential principles of fair investigative practices but also casts doubt on the Committee’s ability to carry out an unbiased and thorough investigation. A more exploratory, open-minded, friendly, and equitable approach would have fostered an environment conducive to candid dialogue and free exchange of information, ensuring a more impartial assessment of the research in question.

It is important to note that the Investigation Committee refrained from asking specific questions about my research or any alleged misconduct. Furthermore, when I was unable to attend scheduled meetings due to prior commitments, such as collaborating with another scientist to replicate the research under investigation, the Committee was unwilling to accommodate my travel schedule. In addition, when unexpected events, like complications following my wife's childbirth, prevented me from attending another meeting, the Committee chose not to reschedule and decided not to meet with me again. These refusals, combined with the Committee’s rigid stance, created an environment that seemed intent on hindering my continued efforts to replicate the scientific results at the heart of the investigation. The challenging atmosphere created by the Investigation Committee posed significant obstacles to my participation in the ongoing inquiry.

IX. The Investigation Committee's Comprehensive Access to Computational Resources and Information.

It is important to respectfully set the record straight regarding the Investigation Committee's portrayal of events, which implies that I obstructed their access to crucial information for the investigation. This claim is not grounded in fact, as the Committee was given full and unrestricted access to all relevant components of my laboratory infrastructure. They had complete access to laboratory spaces, laboratory computers, laboratory notebooks, office computers, office files, and all data pertinent to the investigation. I want to underscore that at no time did I interfere with or restrict the Investigation Committee's ability to obtain any records required for their comprehensive examination.

X. Responses to the Investigation Committee's Incorrect Findings.

In responding respectfully to the Investigation Committee's unfounded allegations of misconduct, it is essential to place my replies within the larger context of potential biases arising from the Committee's composition, their limited expertise in experimental high-pressure, low-temperature superconductivity research, and the conflicts of interest previously identified. The inherent biases linked to the makeup of the Committee prompt concerns regarding the fairness and impartiality of their evaluations. Additionally, the Committee's acknowledged lack of specialized knowledge in the field under scrutiny poses significant challenges in fully grasping the intricacies of the experimental research. As I proceed to provide detailed responses, it is vital to bear in mind these factors, ensuring that the broader context in which these accusations are being examined is thoroughly understood.

A. Draft Report D. Nature 2023 (LuH) Paper.

The Investigation Committee has presented seven allegations which it describes as "[f]alsification and/or fabrication" or "[f]abrication and/or falsification" related to different figures and/or data in the preparation and publication of the Nature 2023 (LuH) Paper. In each of these seven allegations, the Committee claims to identify various elements supporting its accusations. As will be shown through a detailed and comprehensive analysis of the Investigation Committee's draft report, it becomes clear that none of the Committee's assertions are substantiated by the data and evidence that were available to them. Furthermore, I respectfully assert that none of the seven accusations are accurate.

1. The R(T) Data Displayed in Figure 2a of the Nature 2023 (LuH) Paper Was Not Falsified nor Fabricated.

Initially, it is respectfully noted that the Investigation Committee overlooks the fact that the published data supporting Figure 2a in the Nature 2023 (LuH) Paper is identical to the raw data obtained from the sequestered files. Instead, the Committee places emphasis on the difference in data format, pointing out that the sequestered data includes additional columns of information not present in the published data. Respectfully, it must be clarified that Figure 2a accurately reflects the Temperature (K) and Resistance (mΩ) measurements as they were published. Furthermore, the Temperature and Resistance data published is the same as the sequestered data, with the standard

practice of removing the offset voltage applied in these types of measurements. Therefore, the claim that the R(T) data displayed in Figure 2a is falsified and/or fabricated does not hold true.

In our laboratory, we have undertaken studies on established superconductors to enhance our understanding of the constraints associated with measurements under pressure. One frequently utilized material in these investigations is MgB2, known for its superconducting properties at 39 K. Figure 1 below illustrates the results of resistance studies conducted on a superconducting MgB2 sample. The depicted curves represent the Magnitude, Real, and Imaginary parts of the signal as functions of temperature.

The Investigation Committee incorrectly concluded that “Respondent intentionally committed data falsification and/or fabrication of the R(T) data displayed in Figure 2a of the Nature 2023 (LuH) Paper”.

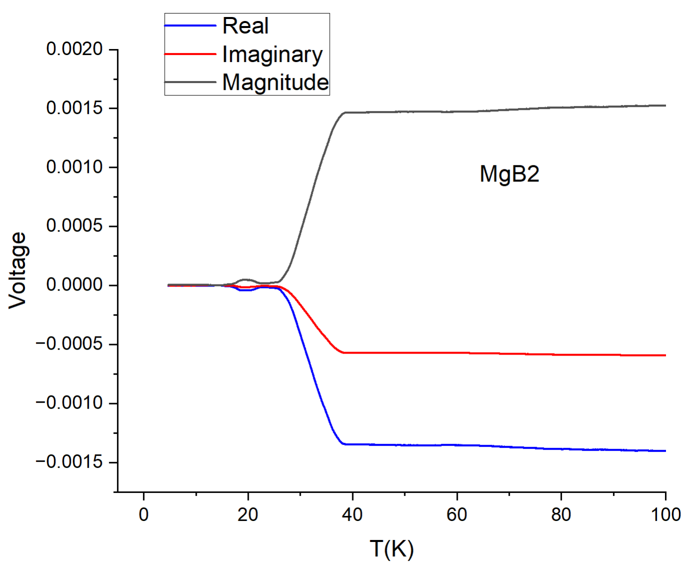

Figure 1. The A.C. resistance measurements of the superconducting MgB2, showing the magnitude, real, and imaginary part of the signal.

As observed in the depicted plot, the imaginary part exhibits a notable contribution, signifying the presence of stray inductance. Please consult the table provided below (Fig. 2), outlining our investigations on frequency-dependent resistance and current-dependent resistance. These studies reveal an increment in resistance with frequency, a characteristic indicative of stray inductance.

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At 60 K

Combination	Current [mA]	Frequency [Hz] 7	17	29	97	307	571
13_24	0.1	0.1930	0.3900	0.5090	0.6186	0.5659	0.4447
	0.5	0.1948	0.3910	0.5086	0.6182	0.5656	0.4444
	1	0.1960	0.3920	0.5091	0.6189	0.5654	0.4450
23_14	0.1	0.0515	0.0914	0.1085	0.1205	0.1155	0.1003
	0.5	0.0516	0.0915	0.1085	0.1205	0.1155	0.1003
	1	0.0516	0.0914	0.1084	0.1204	0.1154	0.1002
12_34	0.1	0.3855	0.6633	0.7732	0.8479	0.8178	0.7221
	0.5	0.3882	0.6636	0.7726	0.8476	0.8178	0.7222
	1	0.3913	0.6640	0.7718	0.8471	0.8176	0.7220
14_23	0.1	0.1337	0.1480	0.1503	0.1515	0.1514	0.1500
	0.5	0.1338	0.1480	0.1503	0.1515	0.1514	0.1501
	1	0.1337	0.1479	0.1502	0.1515	0.1514	0.1501
24_13	0.1	0.6220	0.6593	0.6650	0.6681	0.6685	0.6662
	0.5	0.6216	0.6586	0.6644	0.6678	0.6682	0.6656
	1	0.6213	0.6583	0.6643	0.6678	0.6682	0.6657
34_12	0.1	0.2314	0.4460	0.5590	0.6523	0.6105	0.5006
	0.5	0.2328	0.4464	0.5588	0.6524	0.6102	0.5004
	1	0.2350	0.4481	0.5600	0.6539	0.6119	0.5019

[mOhm]

Figure 2. The frequency dependent resistance measurements of the superconducting MgB2

As explained in the General Understandings section in Appendix I, depicting the magnitude as resistance in this context is misleadingly inaccurate. Rather, the phase-corrected real part offers a more accurate representation of the actual changes in the sample's resistance. To provide clearer insight, I include a focused view of the data during the superconducting state in Figure 3 below, which showcases the real, imaginary, and magnitude components of the signal. It is important to note that zero resistance is not observed, a phenomenon I have previously explained as a challenge under high-pressure conditions due to contributions from stray resistance, stray inductance, and offsets.

To faithfully represent the material's behavior, we have employed phase correction to account for stray inductance, leading to a small residual resistance due to instrument offset, approximately around 4 micro Ohms, as shown in Figure 4. This method is crucial for the accurate interpretation of data from high-pressure experiments, acknowledging that ideal conditions, such as achieving perfect zero resistance, are often impractical due to the limitations inherent in experimental setups. From my perspective, the most effective approach to analyzing resistance phase adjustment is to divide the process into two distinct phases: (i) before the transition and (ii) after the transition.

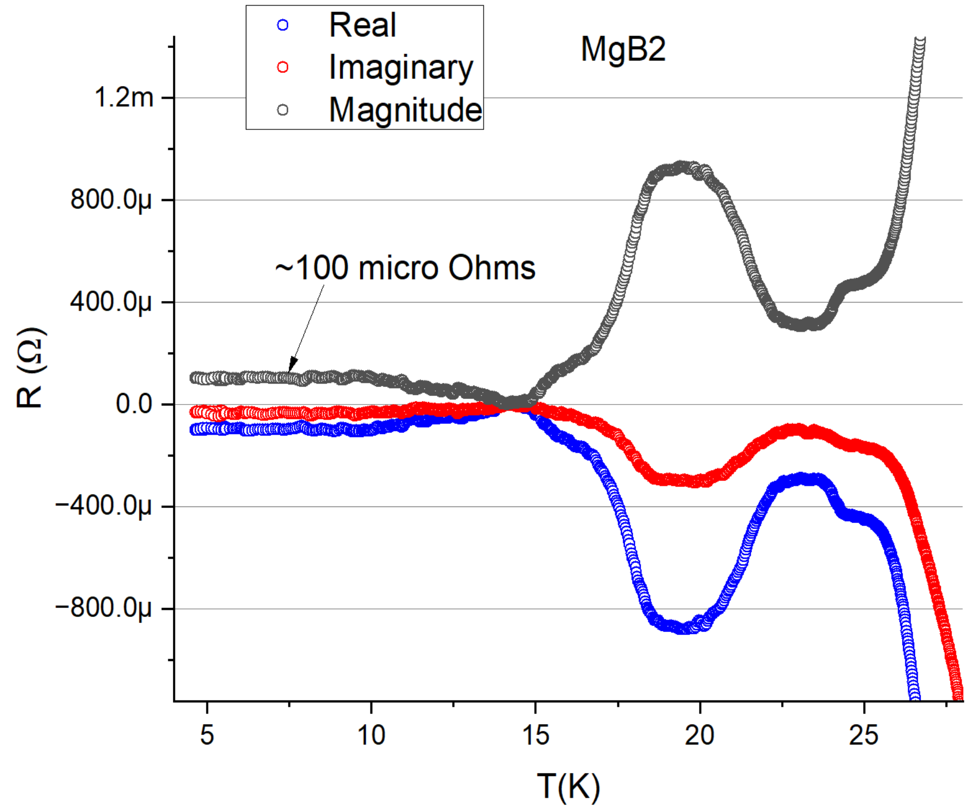


Figure 3. The real, imaginary, and magnitude components of the signal, depicted in blue, red, and black colors, respectively during the superconducting state. The magnitude component indicates a residual resistance of approximately 100 micro Ohms, contrary to the expected zero resistance for this superconducting sample. However, a detailed analysis of the frequency-dependent resistance studies suggests the presence of stray inductance in the setup. Additionally, at around 18 K, there is an observable upturn in resistance, a feature like that seen in the Lu-H-N data at 10 kbar. This pattern suggests that such behavior is common in these types of measurements. To represent the data accurately and effectively, phase correction is necessary.

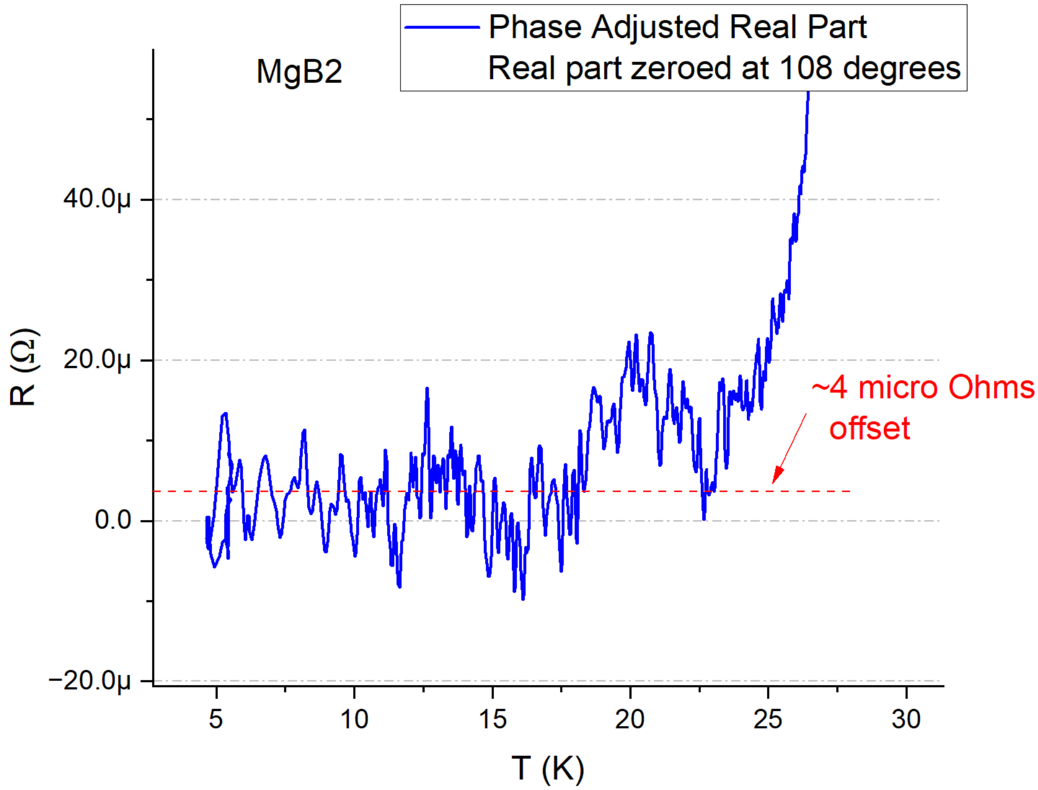


Figure 4. The phase corrected absolute value of the real of the superconducting state of the MgB2 sample. The red dash line indicates the offset value from the instruments.

As shown through the previous two examples involving different types of measurements that require phase correction, heat capacity measurements also necessitate this adjustment. Now, turning to the Investigation Committee's accusations and the relevant data, it is noteworthy that around 18 K, there is a noticeable increase in resistance, reflecting a characteristic like that observed in the Lu-H-N data at 10 kbar. This observation suggests that such behavior is common in these types of measurements. To represent the data accurately and effectively, the application of phase correction is essential. Keeping these examples in mind, let's proceed to examine the data presented in the Nature paper.

It is important to acknowledge that Fig. 2a from the Nature 2023 (LuHN) Paper aims to showcase three distinct measurements at 20 kbar, 16 kbar, and 10 kbar, each corresponding to different transition temperatures.

a. Data Below 235K Was Not Wrongly Omitted and Is Not Misleading (Figure LuH 7 of Draft Report).

Respectfully, I have been wrongfully accused of altering, resampling, shifting, and omitting data for temperatures below 235K. None of these accusations are true. In understanding phase

transitions, a nuanced comprehension of the necessity for phase correction in various measurements is crucial. Regrettably, the Investigation Committee seems to lack the essential knowledge of the complexities involved in high-pressure low-temperature superconductivity experimental research techniques and methodologies.

As demonstrated by earlier examples, different measurements require phase correction for accurate interpretation. The Committee's scrutiny and accusations regarding the data need to be evaluated within the context of this vital correction process.

Moreover, the Investigation Committee neglected to take into account the inherent characteristics when observing similar features, such as the resistance increase around 18 K, in various datasets. This pattern, as observed in the Lu-H-N data at 10 kbar, suggests similar behavior in these measurements due to impedance changes. This was not identified by the Investigation Committee.

For a thorough analysis of the data and allegations, it is imperative that the Committee enhances its understanding, recognizing the nuances inherent in experimental techniques in this specialized field. Such understanding is critical for correctly interpreting phase transitions and avoiding misinterpretations of the presented data.

In Figure 2a of the subject paper, we present a detailed examination of temperature-dependent resistance measurements conducted at three distinct pressures: 20 kbar, 16 kbar, and 10 kbar, showcasing the highest observed transition temperature (Tc) at 294 K. The analysis utilizes a precise 4-probe measurement technique, incorporating both edge and cross configurations. The complete dataset includes the magnitude, real and imaginary components, and the phase of the signal as a function of temperature. Before beginning the experiments, comprehensive guidance was given to the student, highlighting the need to test the setup for non-ohmic behavior and the presence of stray reactance. (See Dylan Durkee's notebook) Unfortunately, the setup showed both non-ohmic contacts and stray reactance, with varying degrees of occurrence in different combinations. Let's explore the specifics of the 20 kbar data.

In this sample, we observe three distinct phase transitions with increasing pressure, labeled as Phase I, II, and III. The pressure ranges for these phases are approximately 0 to 3 kbar for Phase I, 3 to 30 kbar for Phase II, and above 30 kbar for Phase III at room temperature (refer to Figure 5 below). This classification is supported by detailed X-ray diffraction and Raman spectroscopy studies, depicted in Figure 3 below. The transition from Phase I to II indicates an electronic phase change, while the transition from Phase II to III involves a structural distortion from the cubic Fm3m phase II. Notably, a positive slope is observed at the boundary between Phase II and III.

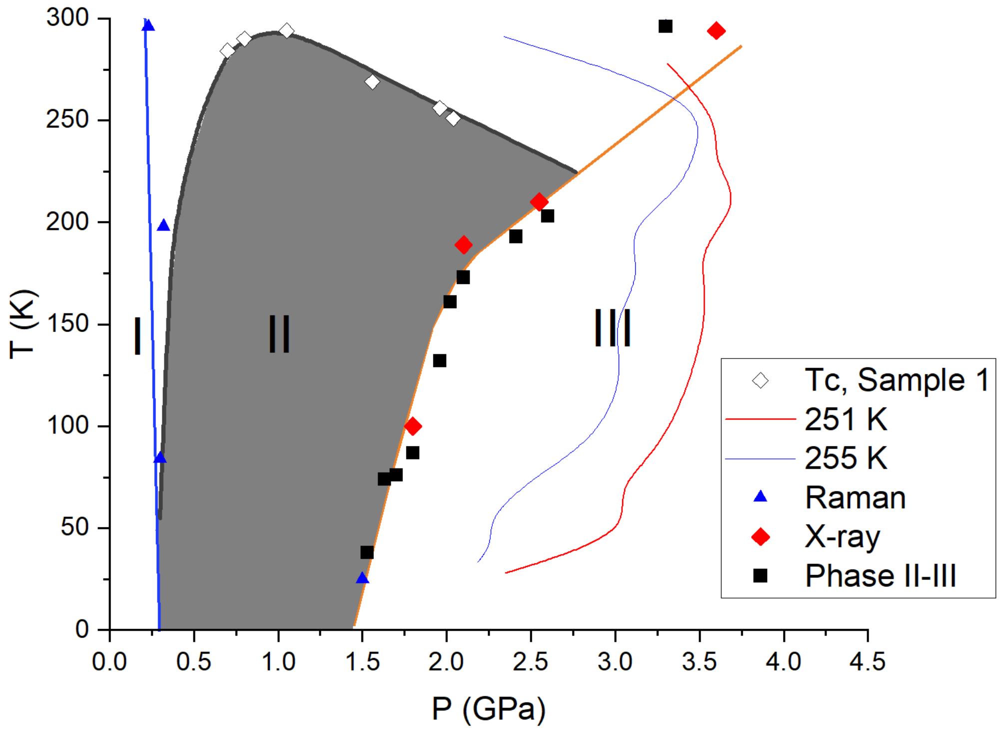


Figure 5. The superconducting dome of nitrogen-doped lutetium hydride as a function of pressure is depicted in the gray area. Superconductivity is only observed within phase II, which occurs between approximately 3 and 30 kbar of pressure. The orange and blue curves represent the pressure changes during the cooling process, where superconductivity was observed during the warm-up at around 251 and 255 K. Generally, during the warm-up phase, a slight further decrease in pressure followed by a relatively constant pressure was observed.

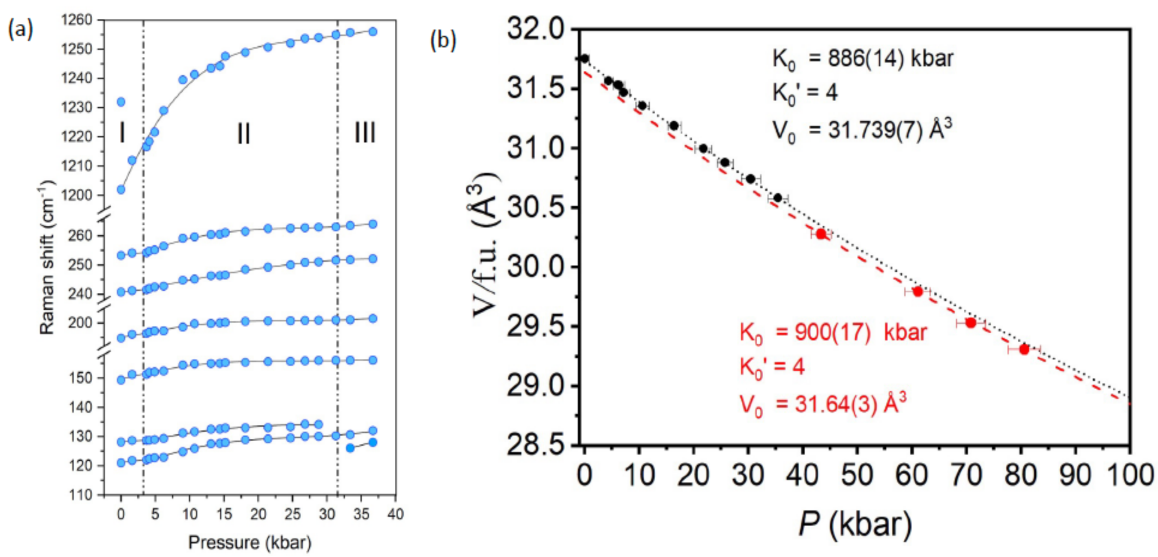


Figure 6 (a) Raman peak position change with pressure. (b) Pressure vs Volume.

A nuanced understanding of pressure variations during both cooling and warming processes is imperative, particularly at extremely low pressures where sample phase transitions occur. The diamond anvil cell, being a substantial mass of metal, undergoes distinct thermal contractions at low temperatures, resulting in pressure variations. The magnitude of this pressure alteration is contingent on several factors, including the initial pressure at room temperature, the specific type of diamond anvil cell (DAC) employed, the size of the diamond culet, the cooling rate, and the characteristics of the cryostat utilized. The diverse nature of these parameters renders the establishment of a universal behavior challenging. Presented herein are examples illustrating this complexity.

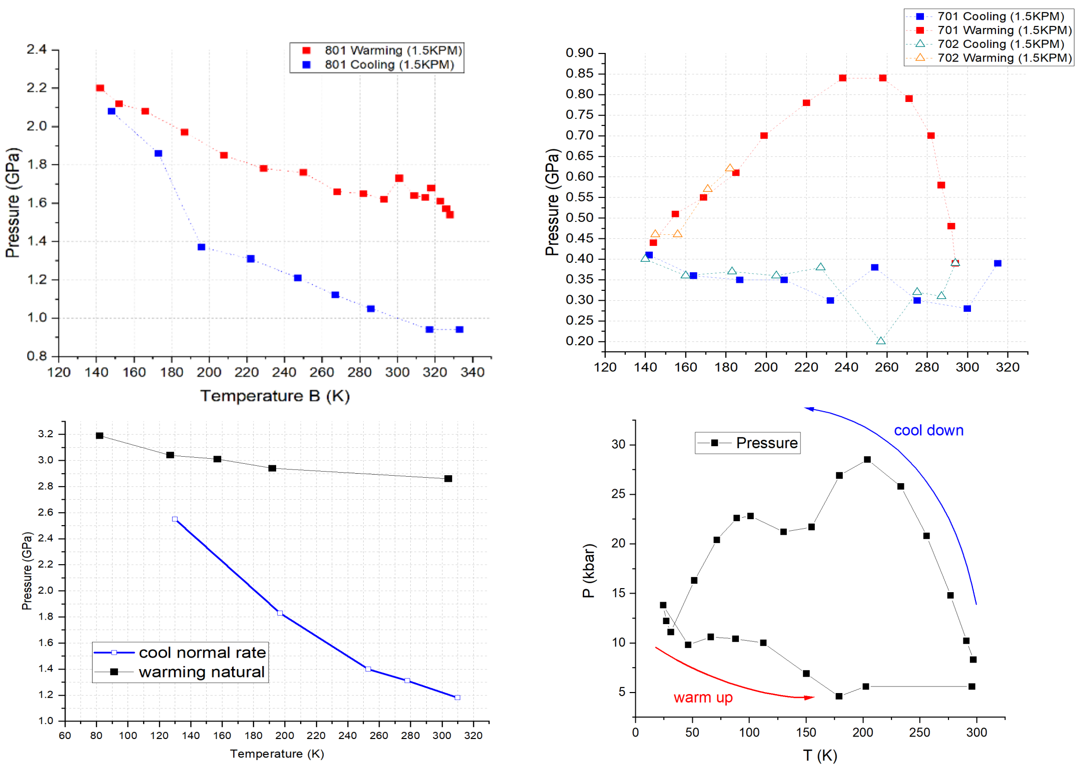


Figure 7 Pressures vs Temperature on a sample in diamond anvil cell.

As depicted in Figure 7, notable pressure variations are evident during both the cooling and warming processes. The initial pressure at room temperature for the 20 kbar data was 41 kbar (before pressure correction due to ruby reference line), and during the cooling phase, the pressure initially increased before gradually decreasing below 200 K. Refer to Figure 8 below, which illustrates the P vs T (Pressure vs Temperature) and Resistance vs Temperature. Notably, within a single phase, such as Phase II, the resistance exhibited minimal changes at room temperature, suggesting that the observed alterations in resistance were primarily attributable to temperature variations. There were no apparent changes to resistance from phase II to phase III. See Figure 8, right.

It is pertinent to mention that pressure measurements were not conducted during the overnight warm-up period. However, it is customary to observe a slight further decrease in pressure during

warm-up, followed by a relatively constant phase, with a gradual increase near room temperature. Such observations align with common trends observed in high-pressure experiments.

During the cooling process, the absence of a superconducting transition was observed, as evident in Figure 8, with the sample consistently maintaining Phase III. Please note that usually, we do not measure and take the data as accurate representation of the measurement during the cooling process due to the rapid cooldown and significant pressure variations.

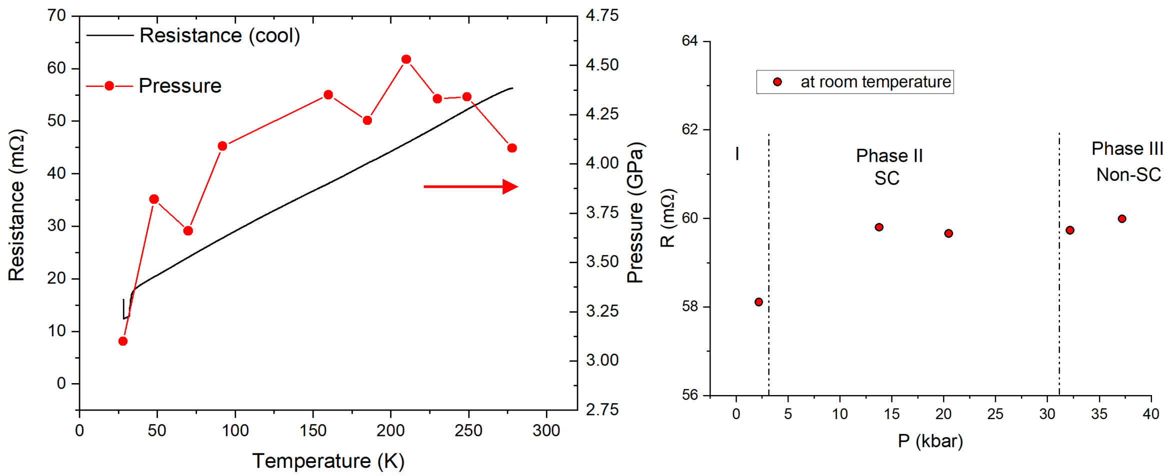


Figure 8 Left: Temperature dependent pressure and resistance measurements conducted during the 20 kbar run. It's important to note that these pressure values are prior to corrections for calibration errors and gradients. Initially, a reference ruby line of 694.22 nm was used, but this was not the calibrated value for the optical system used to measure the Ruby. The correct zero kbar ruby line was 694.35 nm. Therefore, the pressure readings were subsequently corrected. Additionally, there was a pressure discrepancy because the ruby was positioned on diamond powder, not directly on the sample. As a result, the actual pressure experienced by the sample was 3 kbar lower than what was initially measured. See section 9 herein. Right: Resistance changes with pressure at room temperature.

However, the reduction in pressure during cooling proved sufficient to transition the sample into Phase II, known for exhibiting superconductivity upon subsequent warming. Consequently, in the 20 kbar dataset, the entry into complete Phase II occurred only when the temperature reached approximately 225 K during the warm-up phase. The transition from Phase III to Phase II unfolded gradually, commencing at around 175 K (a sluggish transition). After entering Phase II, a discernible superconducting transition was noted, and the sample maintained this phase, with the transition temperature approximately at 251 K. Figure 9 below showcases all three components, including the published data (depicted in green). The phase II and phase III are highly metallic and no apparent change in resistance from crossing over from phase II to phase III or vice versa. See Figure 8, right.

Our decision to limit the plotted data to 235 K stems from our emphasis on reporting the superconducting (SC) phase, specifically Phase II. A comprehensive exploration of the phase diagram at low temperatures is reserved for subsequent investigations and lies beyond the scope of our paper. In the initial paper, our principal focus was on disclosing the discovery of a near-ambient superconductor. It is crucial to clarify that there is no indication of data fabrication or falsification. All pertinent information is meticulously documented in the data files and laboratory notes, a fact that seems to have been either overlooked or deliberately disregarded by the Investigation Committee.

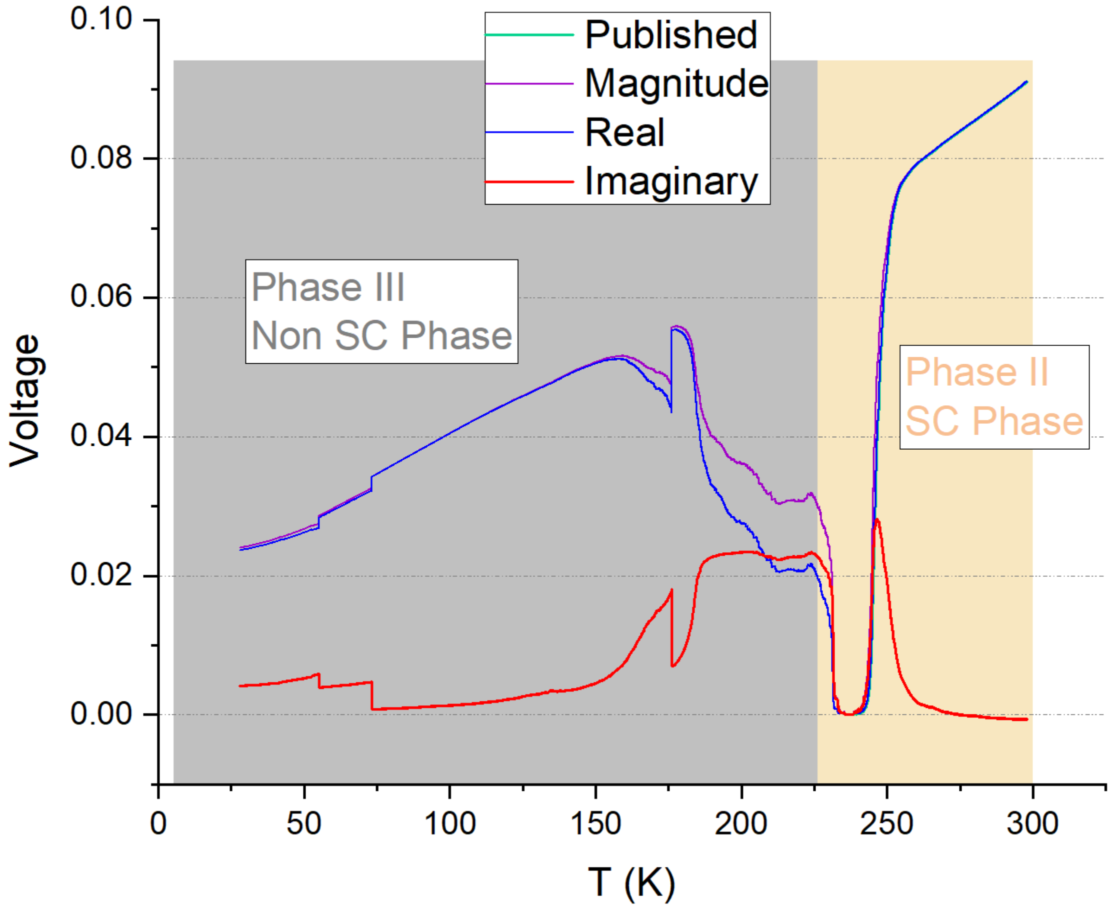


Figure 9. Resistance versus Temperature during the transition from Phase III to II. The figure includes all three components: magnitude, real, and imaginary.

Presenting another example from the same sample and another pressure run, you will see in Figure 10 where the temperature-dependent pressure during the cooling process is illustrated. Notably, the initial pressure stood at 30 kbar, and at 25 K, the pressure recorded was approximately 28 kbar. Throughout the cooling process, as indicated in Figure 10, no superconducting transition was observed, with the sample consistently maintaining Phase III. Nevertheless, the pressure decreases during cooling facilitated the transition of the sample into Phase II, known for exhibiting superconductivity upon subsequent warming. Consequently, the entry into Phase II occurred only

when the temperature reached approximately 160 K during the warm-up phase. The transition from Phase III to Phase II unfolded gradually. Following entry into Phase II, a distinct superconducting transition was observed, and the sample remained in this phase. At this pressure, the transition temperature was around ~255 K. Refer to Figure 11 below for further details.

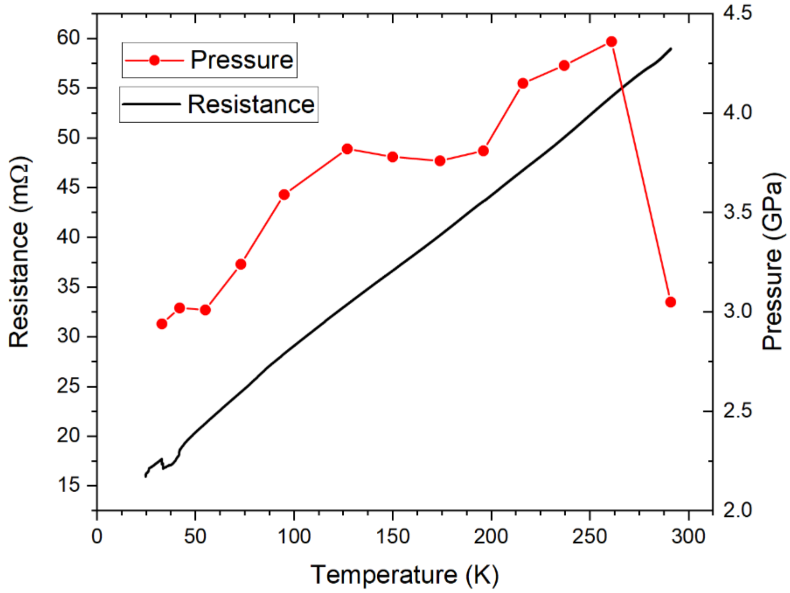


Figure 10. Temperature dependent pressure and resistance measurements conducted during the cooling run. The starting pressure was ~31 kbar. The same pressure correction explained in the Fig, 4 applied for this run as well.

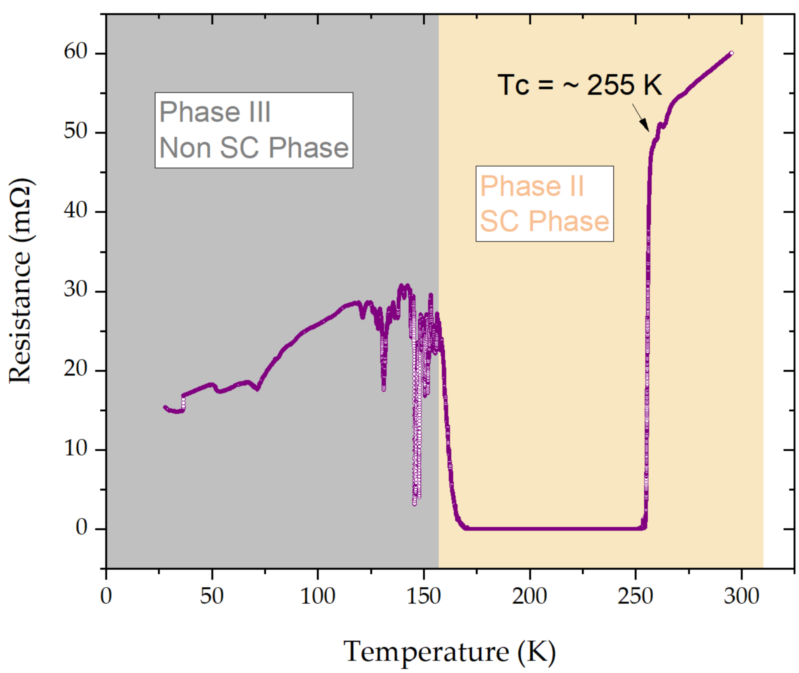


Figure 11. Resistance versus Temperature during the transition from Phase III to II. The phase III is non superconducting, and phase II is superconducting.

b. The Published Data Was Not Resampled at 20kbar (Figure LuH 8 of Draft Report).

Now, let us delve into the allegations pertaining to data alteration, resampling, and temperature axis shifting. The Investigation Committee's findings assert intentional actions by me to manipulate, resample and shift the data. To provide clarity, the raw data in its recorded form will be presented. Figure 12 illustrates the magnitude (depicted in black), real component (in blue), and imaginary component (in red) of the signal.

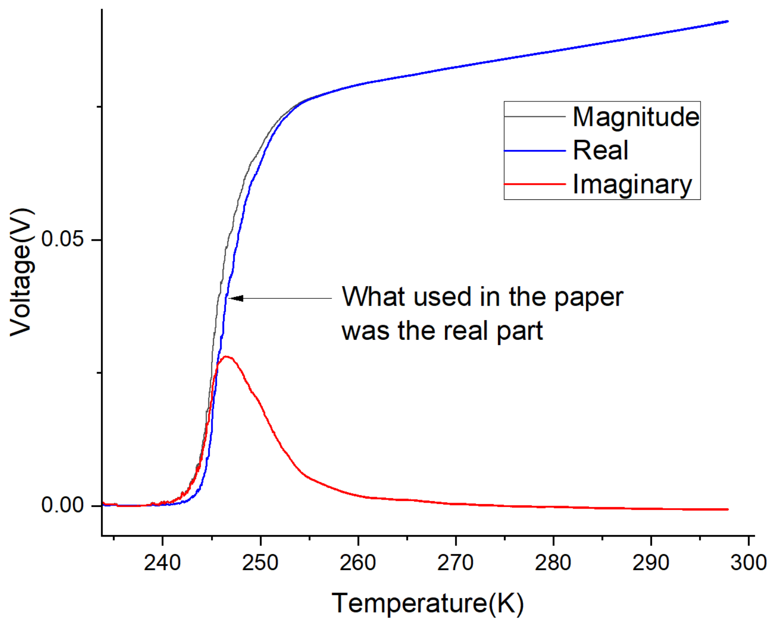


Figure 12. The magnitude, real and imaginary part of the recorded signal with temperature during the superconducting transition at 20 kbar.

Subsequently, we integrate the data presented in Figure 2a of the Nature publication, depicted in green, for the purpose of comparison. Please consult Figure 13 below for a visual representation of this comparison.

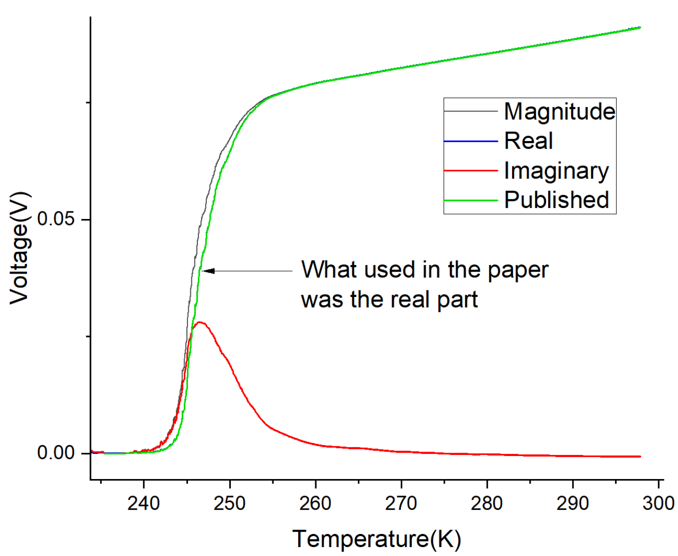


Figure 13. The magnitude, real and imaginary part of the recorded signal with temperature during the superconducting transition at 20 kbar. The green curve represents the data plotted in the Fig. 2a.

The green dataset overlays the blue curve, representing the real part of the signal. Upon meticulous analysis of the data, it has become evident that the observed deviation pertains not to a shift in temperature, but rather to the real part of the signal. This critical detail appears to have been overlooked by the Investigation Committee, which has consequentially led to a misinterpretation of the data. This misinterpretation has unfortunately resulted in unfounded allegations of data fabrication and falsification, culminating in an erroneous accusation of scientific misconduct. It is imperative that this error by the Investigation Committee be rectified to uphold the integrity of the investigative process.

The choice to utilize the real part aligns with the rationale outlined in General Information No. 15 in Appendix I hereto. In frequency-dependent resistance measurements, the revelation of stray inductances within the circuit introduces variations in AC resistance, emphasizing the inadequacy of using the magnitude to calculate resistance. While the conventional approach involves using the magnitude (R) for this purpose, the real part of the signal corresponds to the actual resistive component of the circuit, capturing the in-phase aspect. On the other hand, the imaginary part (quadrature or out-of-phase component) indicative of the reactive component (specifically inductive reactance), suggests that using the magnitude to calculate resistance may not be accurate. Stray inductance introduces phase shifts between current and voltage waveforms, resulting in changes in the phase angle of the impedance (reactance part). This phenomenon significantly impacts the precision of resistance measurements when employing the magnitude for resistance calculation.

It is crucial to underscore that our aim is not to perform precise resistance measurements on an unidentified material. Instead, the primary objective of these temperature-dependent resistance studies is to qualitatively observe the superconducting transition. In this context, the precise initial resistance values hold secondary importance. Even when opting to use the magnitude, closely aligned with the real part, the fundamental interpretation of the data remains unaltered. The focus of our research is primarily on identifying superconducting behavior, rather than on the quantification of exact resistance values. The presence of superconducting behavior was discerned through a significant reduction in resistance, specifically a drop by three orders of magnitude. Such a phenomenon is in alignment with typical observations made in high-pressure superconductivity research. This standard observation underscores the validity of the methodology and findings in our research as reported.

The claim by the Investigation Committee that I resampled the 20 kbar data lacks evidentiary support. In contrast, the available evidence clearly indicates that, when the real part of the data is plotted, it remains consistent. It is with respect that I point out this constitutes a significant oversight on the part of the Committee, an oversight that could have been avoided with a more rigorous and thorough examination of the data before reaching their conclusions. The fundamental methodology of data analysis in question is well-documented and accessible in the scientific literature, as exemplified by the resources provided (refer to https://arxiv.org/abs/2306.06301, and "Magnetic Susceptibility of Superconductors and Other Spin Systems," edited by Robert A. Hein, Thomas L. Francavilla, and Donald H. Liebenberg). The levying of serious accusations such as data falsification or fabrication necessitates incontrovertible evidence. Respectfully, the challenges demonstrated by the Committee in comprehending the data and its analysis cast significant doubts on their ability to conduct an impartial and competent evaluation of the allegations.

c. The Published Data Was Not Altered at 20kbar (Figure LuH 8 of Draft Report).

Now, let us address the allegations regarding resampling and shifting along the resistance axis. Figure 14 below provides an enlarged view of Figure 12, with a specific focus on the voltage values below the transition temperature.

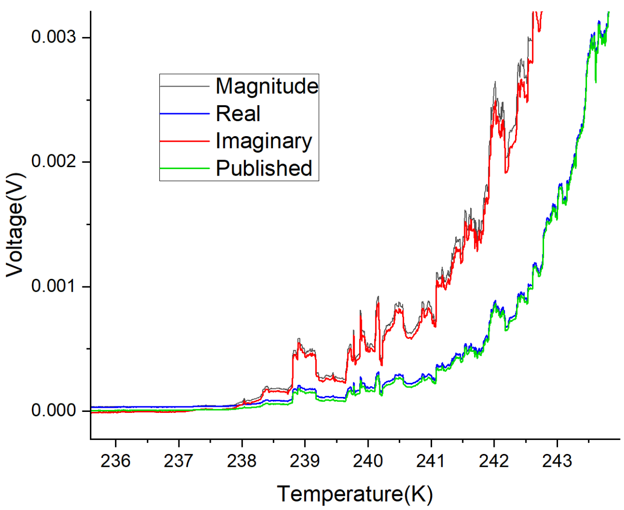


Figure 14. A zoomed-in version of the data at 20 kbar. The real part is depicted in blue, while the published data is shown in green, observed during the superconducting transition.

As depicted in Figure 14, a minor offset is noticeable between the real part (blue curve) of the voltage and the published data voltage (green curve). It is crucial to emphasize that the profiles of the data are identical. As elaborated in General Information No. 12 in Appendix I hereto, achieving zero resistance in high-pressure experiments is a complex task contingent upon various factors, including the sensitivity of the measuring instruments as detailed in General Information No. 12 in Appendix I hereto. Consequently, a meticulous examination of the origins of residual voltages becomes imperative. In our scenario, we identified a small intrinsic offset voltage from the lock-in amplifier, which was subsequently addressed by its removal. Thus, the observed difference arises from the elimination of this small constant offset voltage.

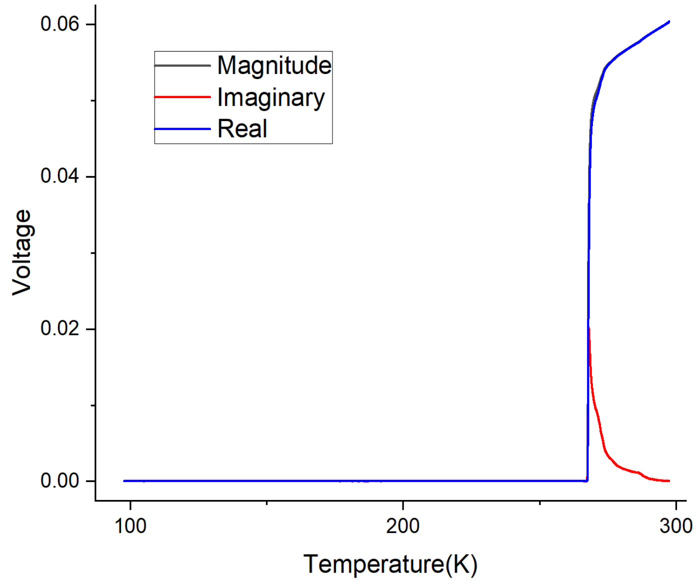
The offset voltage in a lock-in amplifier signifies an undesired voltage introduced by the amplifier itself, potentially affecting measurement accuracy by altering the baseline of the output signal. To counteract this offset voltage, standard practices involve utilizing the built-in offset compensation feature of the lock-in amplifier or recording the offset under identical experimental conditions (sans the actual signal). This recorded value is then removed from the measured data during the analysis. Employing such methods to mitigate offset voltage is a routine procedure in these types of measurements.

It is important to emphasize that the data analysis processes I employed are standard practices in scientific research and should not be construed as indications of data fabrication or falsification. I respectfully acknowledge that the Investigation Committee's oversight and misinterpretation of the AC electrical resistance data have led to a significant error in their judgment and undermines

the Committee's data interpretation resulting in the misplaced conclusion of scientific misconduct. A detailed review of the data, coupled with a comprehensive understanding of its context, could have avoided this situation. The Committee's conclusion that I altered, resampled, and shifted the data at 20 kbar is based solely on the uninformed statements of students and a superficial examination of the signal's magnitude (voltage). This method is notably insufficient for investigating a high-profile case with substantial implications. The approach taken by the Investigation Committee suggests the possibility of a preconceived perspective, which may indicate that their findings were reached without a comprehensive and objective evaluation of all the available evidence.

d. The Signal Was Not Subtracted Between 100K and 270K at 16 kbar (Figure LuH 6 of Draft Report).

The Investigation Committee has leveled analogous accusations concerning the 16 kbar data presented in Figure 2a, asserting fabrication and/or falsification of the data. To provide clarity, we present the raw data in its recorded form. Figure 15 below illustrates the magnitude (depicted in black), real component (in blue), and imaginary component (in red) of the signal.



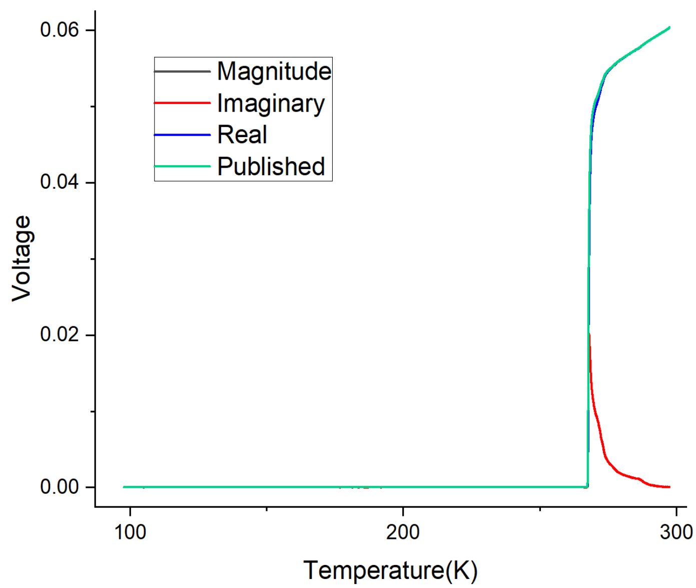


Figure 15 (Top) The magnitude, real, and imaginary parts of the recorded signal as a function of temperature during the superconducting transition at 16 kbar. (Bottom) Same data plot with the published data in Fig. 2a of the Nature paper, represented by the green curve. As evident, the green curve aligns with the black curve.

As evident, the green dataset overlays the black curve, representing the magnitude of the signal. To provide a clearer view, an additional plot is included, a zoomed-in version focusing on the temperature range from 260 K to 280 K, elucidating the two curves distinctly. Refer to Figure 16 below for further clarification.

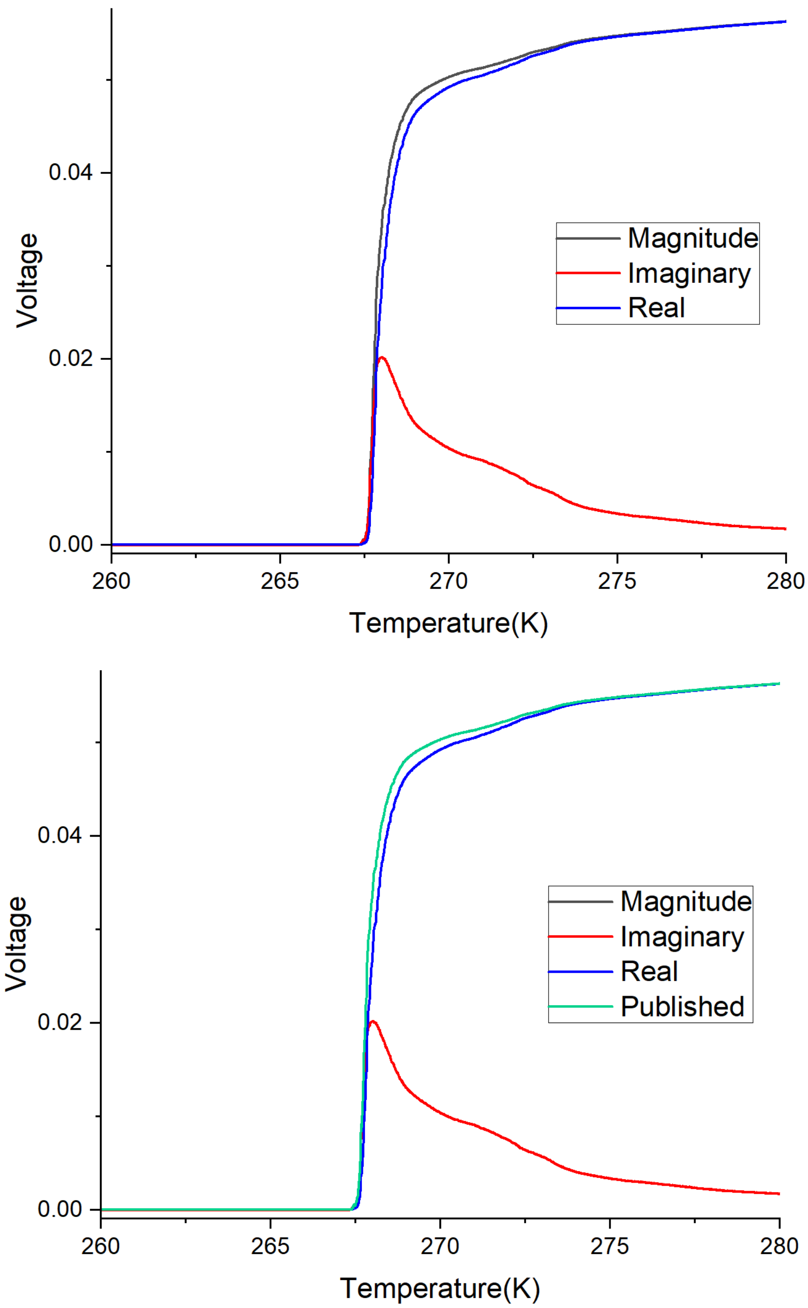


Figure 16 (Top) Zoom in version of the magnitude, real, and imaginary parts of the recorded signal as a function of temperature during the superconducting transition at 16 kbar. (Bottom) Same data plot with the published data in Fig. 2a of the Nature paper, represented by the green curve. As evident, the green curve aligns with the black curve.

The justification for employing the magnitude is expounded in General Information No. 15 in Appendix I hereto. The resistance measurement, reliant on frequency dependence, remained relatively constant, indicating the presence of only a minor stray inductance in the circuit. As a

general practice, the magnitude is utilized for resistance calculation, and in this instance, there was adherence to this convention. The small stray inductance in the circuit may introduce a slight phase shift between the current and voltage waveforms.

Now, let's examine the data post-superconducting transition (below Tc). Figure 14 illustrates the raw data for the 16 kbar run, where the black curve represents the magnitude, the blue curve represents the real part, and the red curve represents the imaginary part of the signal.

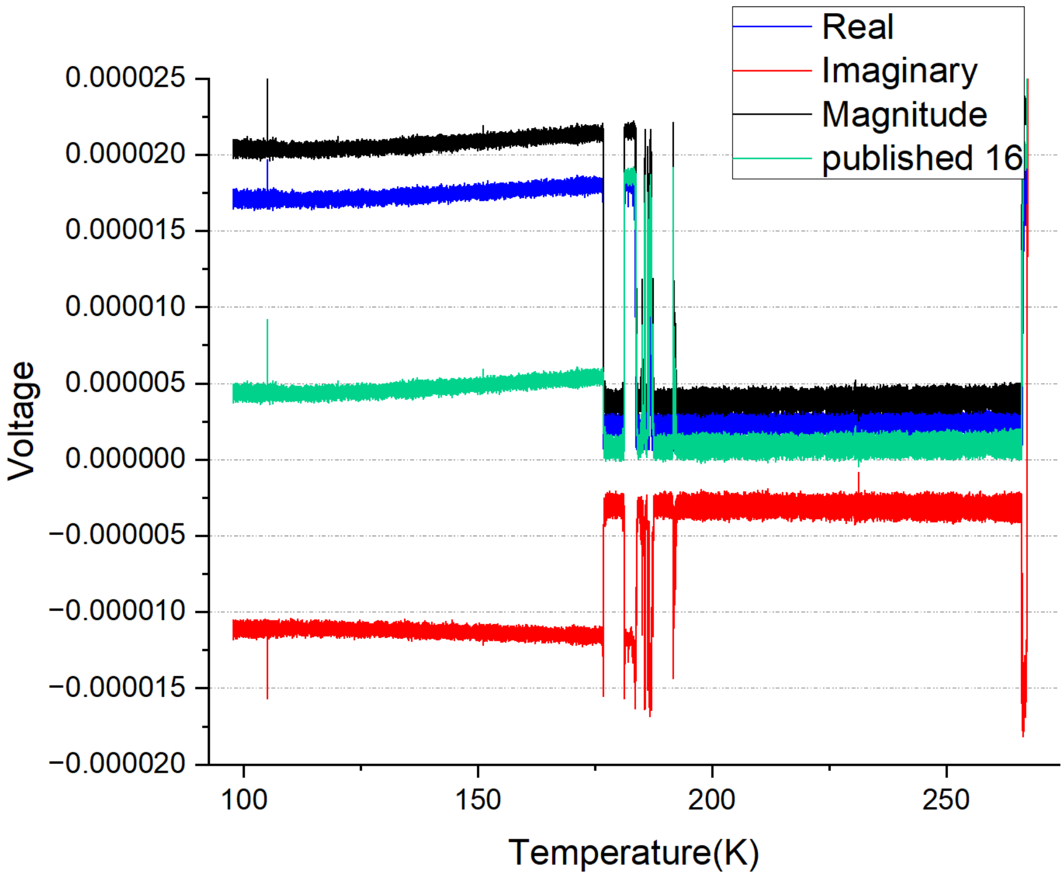


Figure 17. A zoomed-in version of the recorded data at 16 kbar, showing the recorded data after the superconducting transition (< Tc). The magnitude is depicted in black, while the real and Imaginary part is in blue and red respectively. The green curve represents the published data in Fig. 2a Nature paper.

Let's analyze the data across superconducting temperature regimes. Beginning with the data above 175 K, as depicted in Figure 17, a slight offset is noticeable between the magnitude of the signal (black curve) and the published data (green curve). Importantly, the overall profiles of these datasets remain consistent. As previously discussed in General Information No. 12 in Appendix I hereto, achieving zero resistance in high-pressure experiments is inherently challenging, influenced by factors such as the sensitivity of measuring instruments (refer to General Information

No. 12 for comprehensive details). This complexity necessitates a thorough investigation into the origins of any observed residual voltages.

While lock-in amplifiers effectively reduce noise, they introduce phase ambiguity when using only the voltage magnitude. This observation underscores the intricate interplay between the experimental setup and the intrinsic properties of the sample under high-pressure conditions. As described in General Information No. 13 in Appendix I hereto, using magnitude (|ΔV|) to calculate resistance results in a positive offset, due to the phase shift in zero-resistance materials like superconductors, scaling with noise levels. As SNR drops below 1, this offset increases. In a superconductor, where the voltage drops across the sample is zero which results in a, $SNR = \frac{\Delta V}{V_{noise}} \ll 1$ noise, regardless of the level of noise in the measurement. Consequently, using R =|ΔV| to calculate resistance results in values that are consistently clustered around an offset value proportional to the noise level of the measurement, necessitating its removal. Thus, the observed difference is due to the removal of this small constant offset voltage.

Turning our attention to the data below 175 K, as depicted in Figure 17, there is a discernible, albeit slight, discrepancy between the magnitude of the signal (represented by the black curve) and the published data (illustrated by the green curve). The degree of this offset correlates with the noise level inherent in the measurement process. It becomes clear that below 175 K, an augmented noise level contributes to the offset, like the explanation provided for the data above 175 K. This observation serves to underscore the impact of offset voltage in these two distinct temperature regimes.

Additionally, I want to emphasize that the removal of the above-mentioned offset from the recorded data is comparable to the phase adjustment described in General Information No. 18 in Appendix I hereto. In our experimental setup, various factors introduce a phase shift, such as the SRS 554 pre-amp and changes in circuit impedance, which can distort the accurate phase information originating from the sample under study. Consequently, compensatory phase adjustments are necessary to ensure accurate phase information. For the resistance measurement, this adjustment process typically involves tuning the phase until the real part of the lock-in amplifier's output accurately represents the in-phase component of the signal. This helps in accurately extracting the signal of interest, especially in environments with high noise or interference. In a superconducting transition, the resistance should theoretically be zero (well below its critical temperature (Tc)); any deviation from this could be due to stray reactance, noise, offset, or a shift due to the use of the SRS 554 pre-amp. During the data analysis process on the Lu-H-N system, I performed this task manually. However, we now have a Python program that enables us to visualize, examine, and save the phase-adjusted data. I have attached the program for conducting any necessary phase adjustment tests. Figure 18 below demonstrates various phase adjustments applied to the 16 kbar resistance data. As indicated, adjusting the phase provided a way to overcome the experimental limitations to understand the superconducting transition in the sample during the post-data processing stage.

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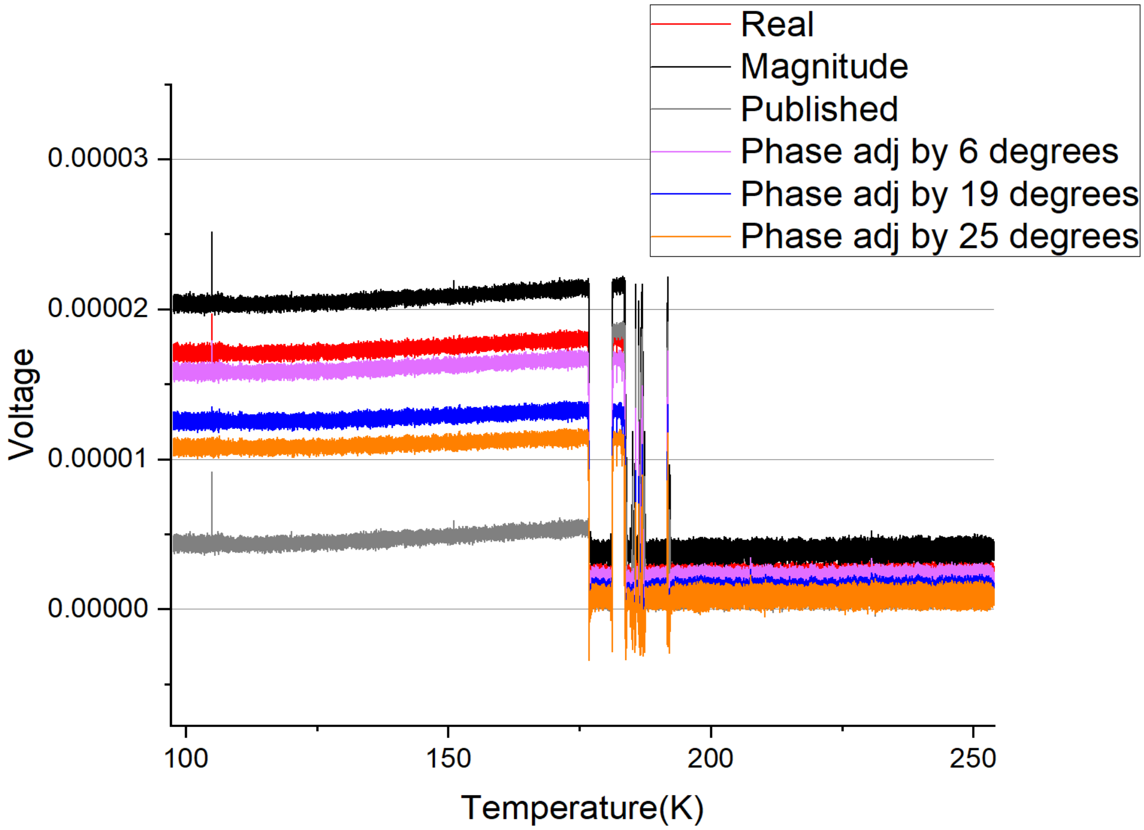

Figure 18. A zoomed-in version of the recorded data at 16 kbar, showing the data after the superconducting transition (< Tc), which various phase adjustments. The phase angle θ of the lock-in amplifier used to detect the voltage must be adjusted to correctly separate the real and imaginary parts of the measurement. The adjustment can be done by computation after the measurement:

$Re'(T) = Re(T). Cos\theta + Im(T). Sin\theta$

$Im'(T) = Im(T) . cos\theta - Re(T). Sin\theta$

Where, Re and Im are measured real and imaginary part before adjusting the phase angle.

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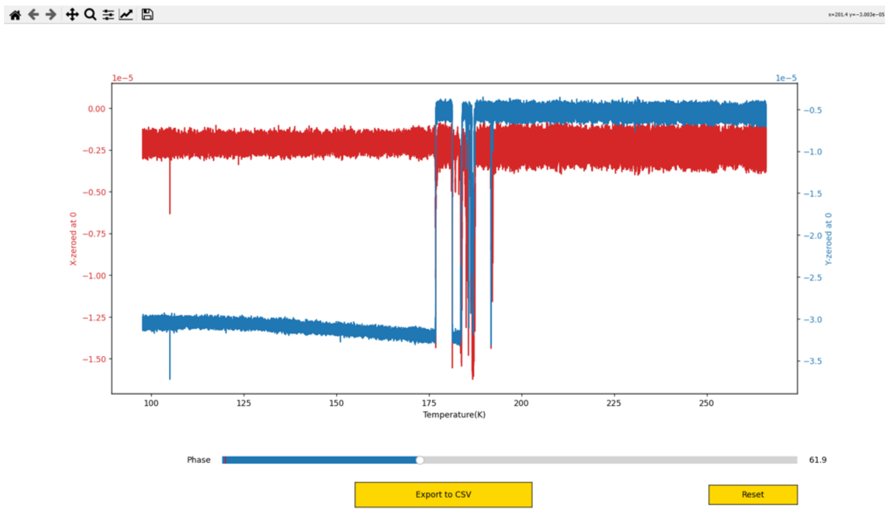


Figure 19. A screen shot of the Python program that enables us to visualize, examine, and save the phase-adjusted data. The phase adjustment was performed to 16 kbar low temperature

e. The Signal Was Not Subtracted Between 100K and 290K at 10kbar (Figure LuH 3 of Draft Report).

The Investigation Committee has raised similar allegations concerning the 10 kbar data shown in Figure 2a, suggesting intentional fabrication and/or falsification of the data. To provide clarification, we present the raw data exactly as recorded. Below is Figure 20, illustrating the magnitude (in black) alongside the published data from the Nature paper.

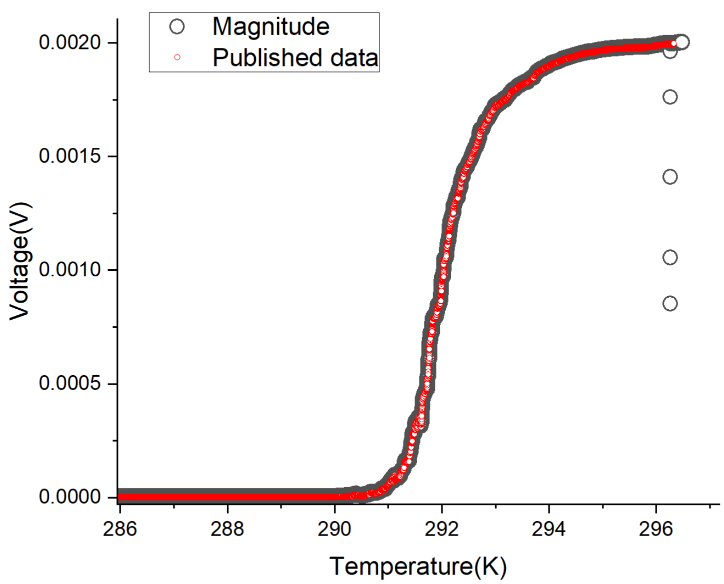


Figure 20. The magnitude of the recorded signal as a function of temperature during the superconducting transition at 10 kbar (black) with the published data in Fig. 2a of the Nature paper, represented by the curve. As evident, the curve aligns with the black curve. The published data plot up to 296.33 K and magnitude goes up to 296.48 K.

In this specific pressure point, the utilization of the magnitude data was necessitated by an error made during the experiment. Generally, our standard practice involves attempting to zero the phase at the initiation of the experiment to mitigate the phase shift induced by the pre-amp, even though this approach doesn't entirely correct for the phase shift resulting from impedance changes in the circuit. However, this calibration is typically executed just before the cooling process initiates, not at the lowest temperature. However, by mistake zeroed the phase at approximately ~28 K, a point occurring after the superconducting transition. This untimely adjustment disrupted the phase alignment. Consequently, I had no alternative but to rely on the magnitude of the signal for resistance calculations. Please refer to Figure 21, which depicts the zeroing of the phase at approximately 28 K.

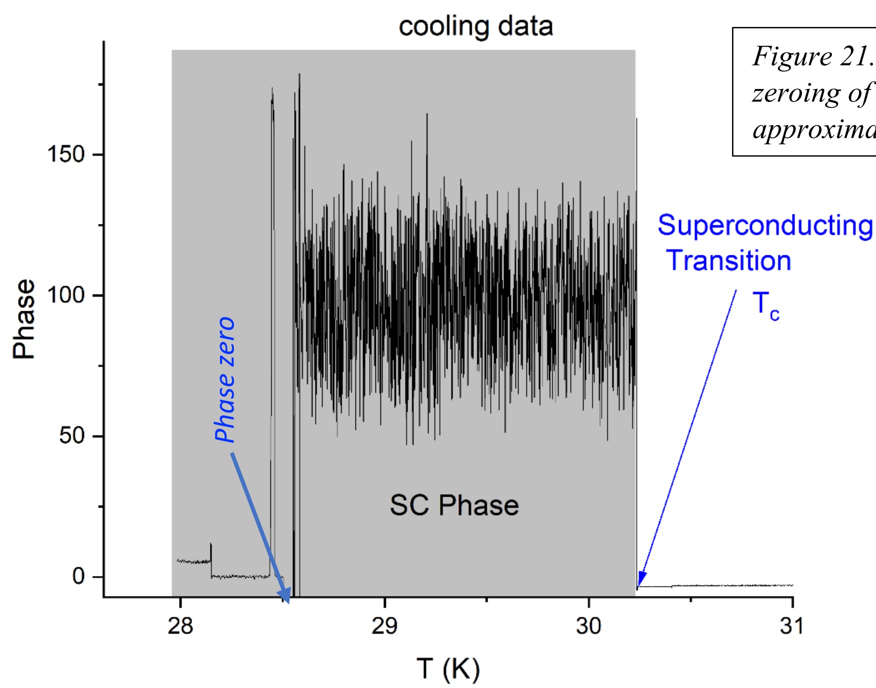


Figure 21. Illustrates the zeroing of the phase at approximately 28 K.

As is customary, Figure 22 below displays the data at elevated temperatures before the onset of the superconducting transition. The frequency-dependent resistance measurements (See Dylan Durkee's Notebook) unveil the presence of stray inductances and capacitance. As evident, there exists an offset between the black and green data points.

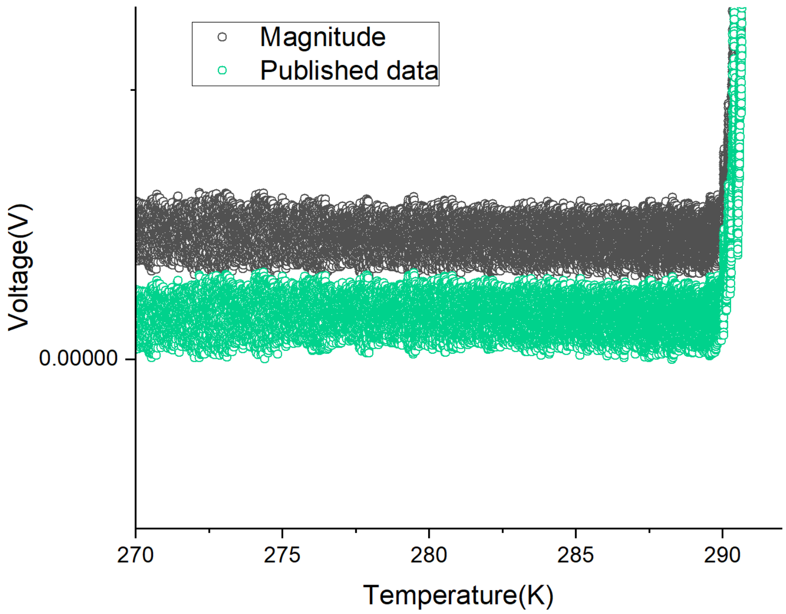


Figure 22. Temperature-dependent voltage just below the transition temperature at 10 kbar is shown, with recorded data in black and published data in green.

This reactance introduces a phase shift, consequently altering the phase angle of the impedance (reactance component). Such a change in phase angle affects the magnitude of the measured signal, resulting in a noticeable positive offset. This observation underscores the intricate interplay between the experimental setup and the intrinsic properties of the sample under high-pressure conditions. As described in the General Information No. 13 in Appendix I hereto, using magnitude (|ΔV|) to calculate resistance results in a positive offset, due to phase shift in zero-resistance materials like superconductors, scaling with noise levels. As SNR drops below 1, this offset increases. In a superconductor, where the voltage drops across the sample is zero which results in a, $SNR = \frac{\Delta V}{V_{noise}} \ll 1$ noise, regardless of the level of noise in the measurement. Consequently, using R =|ΔV| to calculate resistance results in values that are consistently clustered around an offset value proportional to the noise level of the measurement, which necessitates its removal. Thus, the observed difference is a result of the removal of this small constant offset voltage.

However, these offset changes are based on the constant or slight variation of the phase angle with temperature. If there is a significant change in the phase, using a constant offset is not accurate, signifying the necessity for a temperature-dependent offset voltage. Let's examine the phase changes during the superconducting state in the 10 kbar run. As depicted in Fig. 23, there is a substantial change in phase with temperature.

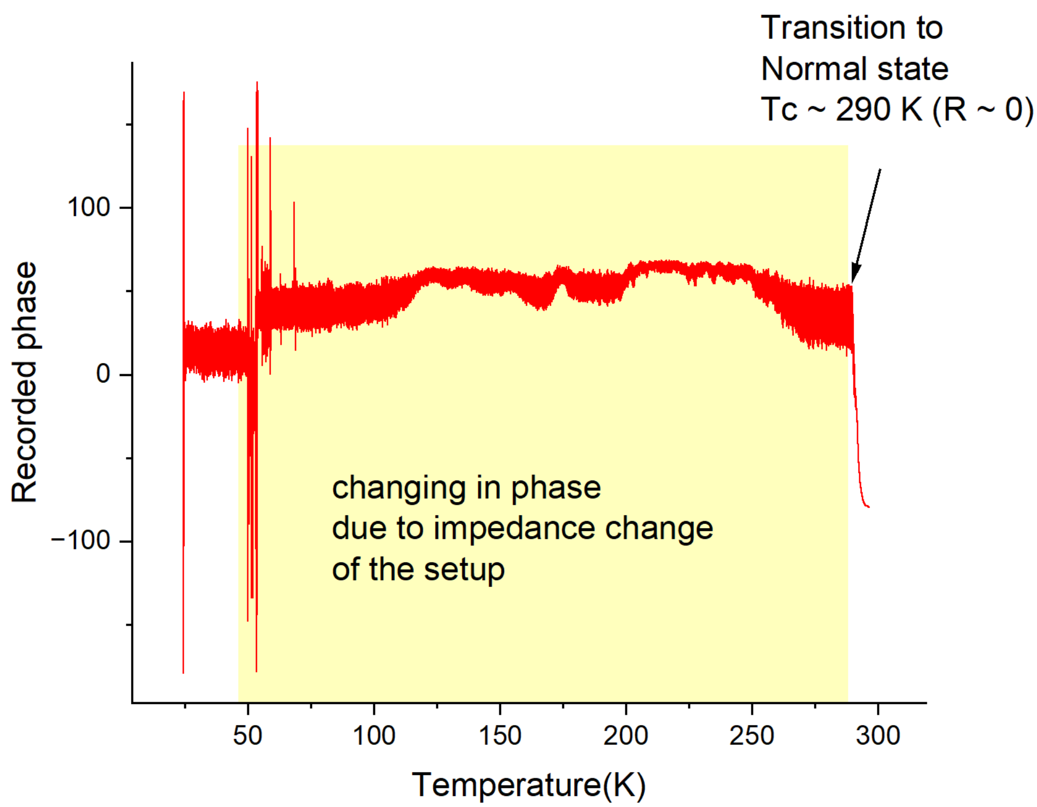


Figure 23. The temperature dependent phase change below the superconducting transition temperature at 10 kbar.

As depicted in Figure 23, the phase of the signal underwent substantial changes within the temperature range of 100 K to 270 K. This temperature-dependent phase shift influences the magnitude of the measured signal, resulting in a noticeable temperature-dependent positive offset. Figure 24 presents both the magnitude and the real part of the signal during the 10 kbar superconducting transition at 294 K. The inset offers a magnified view of the temperature range from 100 K to 270 K, emphasizing variations in both the magnitude values and the real part.

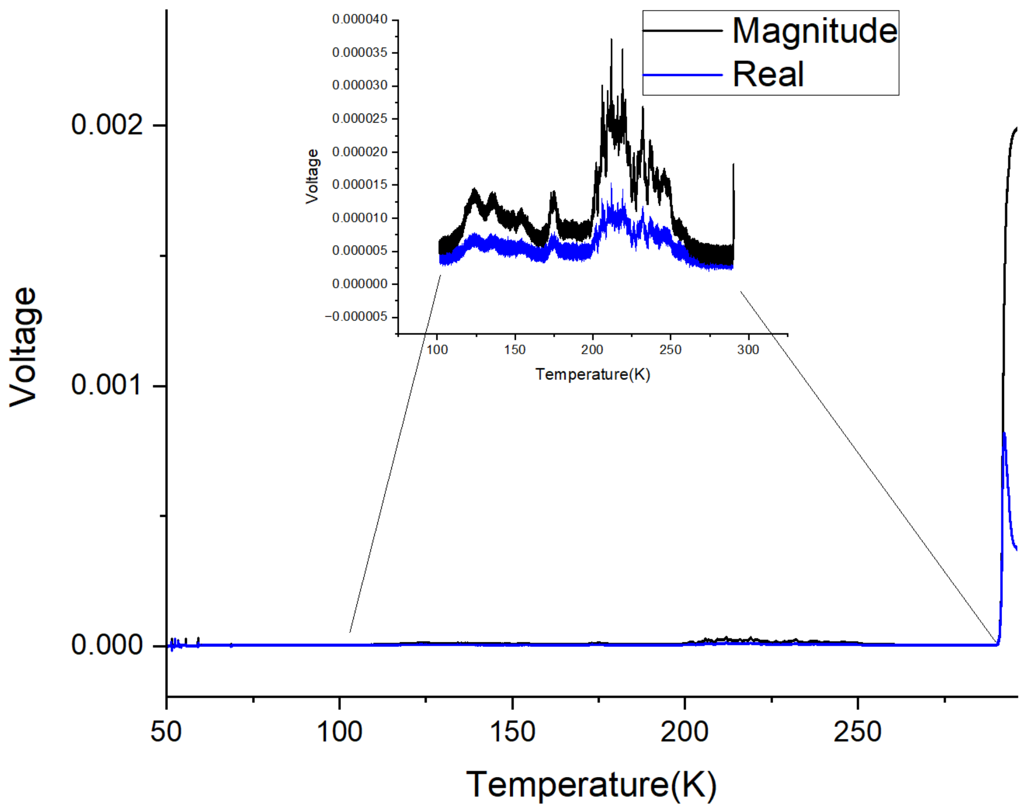


Figure 24. The temperature-dependent magnitude and real part of the data at 10 kbar. The inset displays a zoomed-in view of the range between 100 K and 270 K.

This observation underscores the intricate interplay between the experimental setup and the intrinsic properties of the sample under high-pressure conditions. As outlined in the background section, specifically in General Information No. 13 in Appendix I hereto, the use of magnitude (|ΔV|) for resistance calculations introduces a positive offset due to phase shifts in zero-resistance materials like superconductors, which scales with noise levels. As the signal-to-noise ratio (SNR) drops below 1, this offset increases. In a superconductor, where the voltage drops across the sample are zero, which results in a, $SNR = \frac{\Delta V}{V_{noise}} \ll 1$ noise, regardless of the level of noise in the measurement. Consequently, utilizing R = |ΔV| to calculate resistance yields values consistently clustered around an offset proportional to the noise level, necessitating its removal. Thus, the observed difference is a consequence of removing this temperature-dependent offset voltage.

All the data presented at 10, 16, and 20 kbar shows a clear superconductive transition without any offset removal. The offset removal or phase adjustment is solely attributable to the experimental limitation in observing true zero resistance. As detailed in the background information section, specifically in General Information No. 18 in Appendix I hereto, phase adjustment is essential to eliminate the background offset arising from inductive reactance. For resistance measurements, this adjustment typically involves tuning the phase until the real part of the lock-in amplifier's

output accurately represents the in-phase component of the signal, aiding to accurately separate the real and imaginary part of the signal of interest. See MgB2 example given in the background section. During the data analysis process on the Lu-H-N system, I initially performed this task manually. However, we now utilize a Python program that allows visualization, examination, and storage of the phase-adjusted data. Figure 25 below illustrates phase adjustments applied to the 10 kbar resistance data below the superconducting transition temperature. As indicated, adjusting the phase of the real part provides a means to overcome experimental limitations and enhance the understanding of the superconducting transition in the sample during the post-data processing stage.

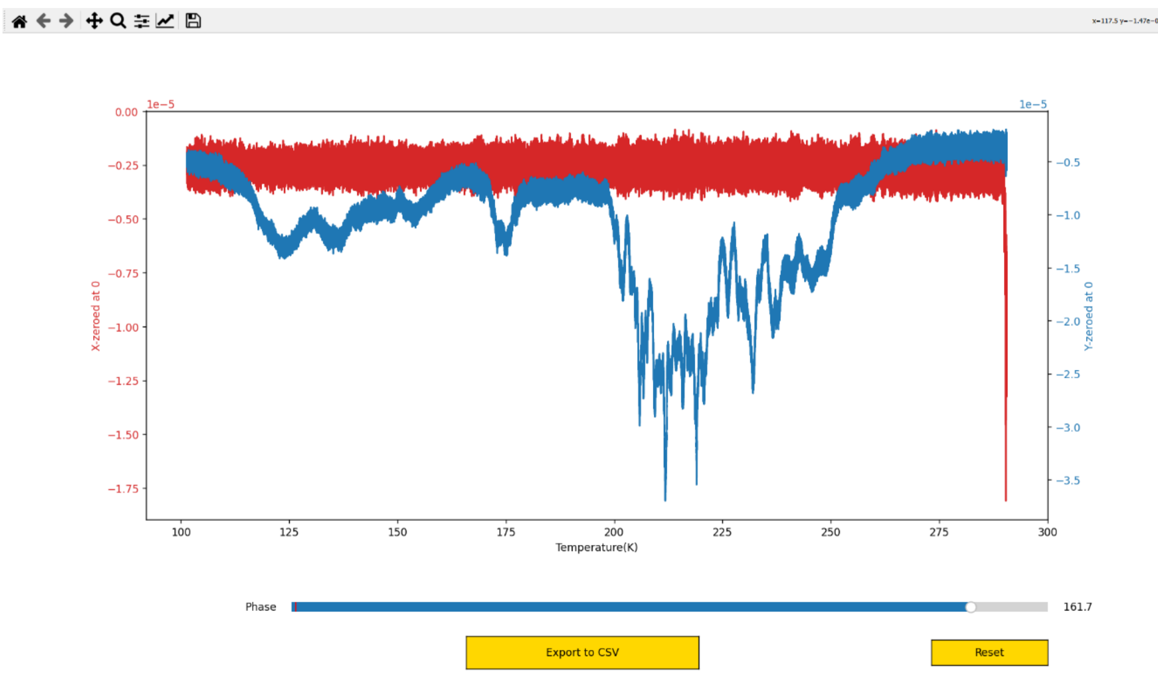


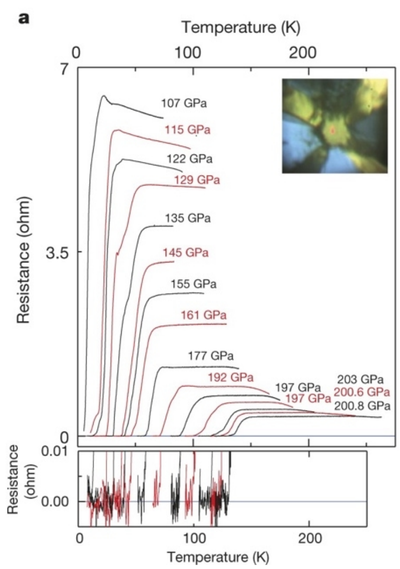
Figure 25. A screenshot of the Python program interface, captured during the phase adjustment for the 10 kbar data (below Tc), is presented. It shows the process of tuning the phase until the real part of the lock-in amplifier's output accurately reflects the in-phase component of the signal.

Ideally, the calculation of resistance should rely on the real part of the signal. However, the process of zeroing the phase during the superconducting state at low temperatures complicates the interpretation of the setup's impedance change. It appears that this procedure led to a phase flip, resulting in a negative real part. In my perspective, for future AC resistance measurements, it is crucial to meticulously examine both the real and imaginary parts of the signal. Employing the real part with careful phase adjustment can significantly enhance our data analysis and understanding of the superconducting state.

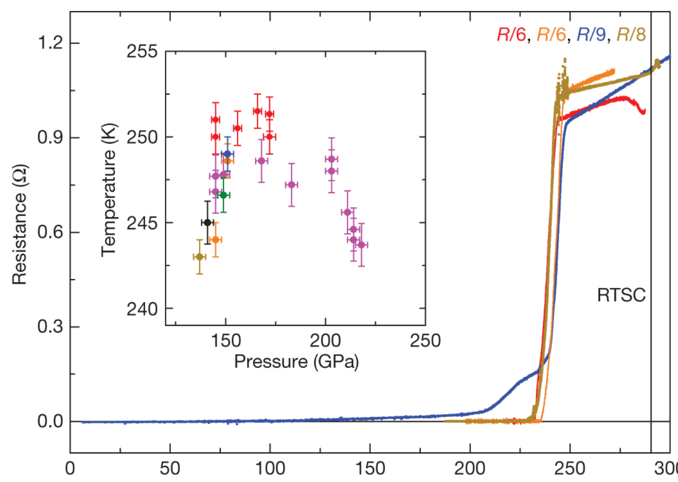
I have elucidated the scientific rationale behind the removal of the offset from the three resistance datasets and have provided a detailed account of the measurement process and data analysis. The

data processing steps I employed are not fabrications or falsifications of data but rather standard practices in the field. The Investigation Committee's accusation that this process was intended to artificially demonstrate a zero-resistance state for the materials, citing that the values are typical for such measurements in the field, is unfounded. For the three pressure points, the resistance values in the superconducting state were approximately 4 micro-ohms for 20 kbar, 2 micro ohms for 16 kbar, and 3- micro ohm for 10 kbar, each presenting three distinct values. It is unclear to me what values the Investigation Committee perceived as expected. Experimentally observing true zero resistance is a challenging task. Often, what we rely on is a qualitative change, such as a significant change in resistance, rather than an absolute zero reading. Therefore, removing residual resistance is a necessary and common practice in high-pressure superconductivity studies.

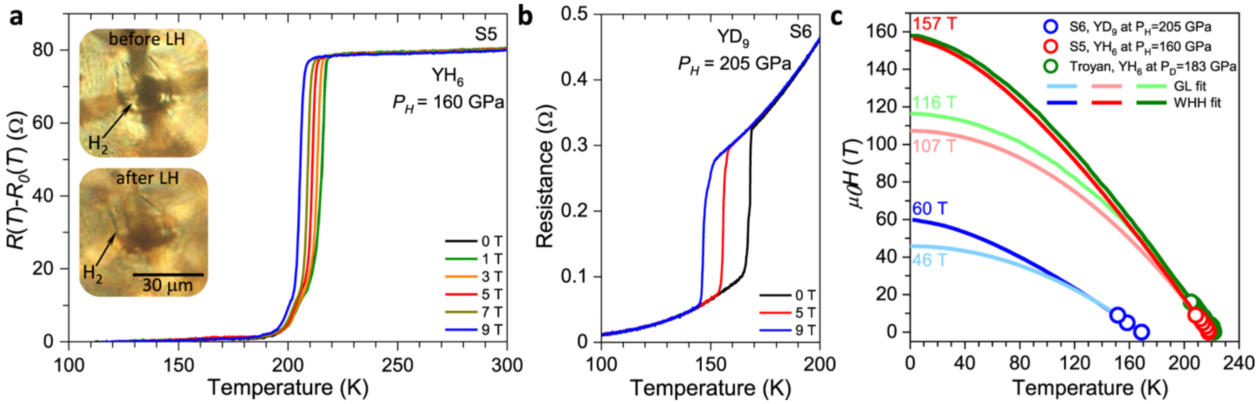
The resistance data alone are insufficient to conclusively evidence superconductivity. Consequently, final data interpretations are frequently corroborated with other measurement techniques. These can include IV (current-voltage) curves, field-dependence studies, and magnetic susceptibility measurement. I would like to provide a few examples of the zero-resistance state published in the high-pressure superconducting community. (See *Drozdov A. P et al., Nature 525, 73-76 (2015); Somayazulu, M. et al., Phys. Rev. Lett. 122, 027001 (2019); Drozdov, A. P et al., Nature 569, 528-531 (2019); Semenok, D. V. et al., Mater. Today 48, 18-28 (2021); Ma, L. et al., Phys. Rev. Lett. 128, 167001 (2022); Li, Z. et al,. Nat. Commun. 13, 2863 (2022).*) In these examples, none have demonstrated zero resistance, and their baseline values are typically in the milli Ohms range (very high), in contrast to our observations in the micro-Ohms range without any offset removal.



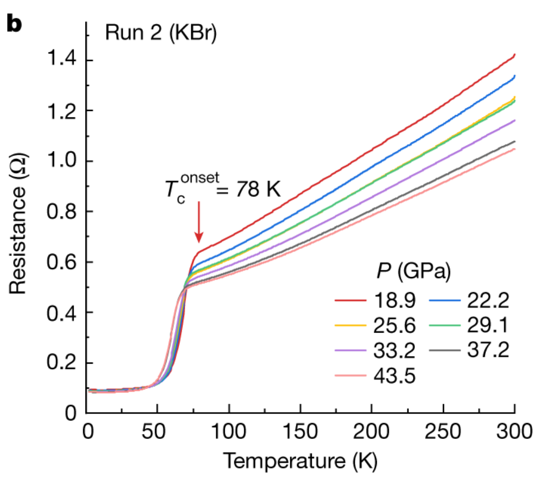
H_3S superconducts, zero state is about 5 milli Ohms. This is three orders of magnitude higher than what we observed before doing any offset removal. Our values are in micro Ohms range.



LaH10 superconductivity study, zero state resistance around 8 to 14 milli Ohms. Notably, what we observed was in the micro-Ohms range, which is three orders of magnitude lower than the values recorded prior to performing any offset removal.



YH9 superconductivity study, zero state resistance is about 15 to 25 milli Ohms for YH6 and 12 milli ohms in Figure b. Notably, what we observed was in the micro-Ohms range, which is three orders of magnitude lower than the values recorded prior to performing any offset removal.



La3Ni2O7 superconductivity study, zero state resistance is about 100 milli Ohms. Notably, what we observed was in the micro-Ohms range, which is three orders of magnitude lower than the values recorded prior to performing any offset removal.

CaH6 superconducts, zero state is about 2000 milli Ohms. This is six orders of magnitude higher than what we observed before doing any offset removal. Our values are in micro Ohms range.

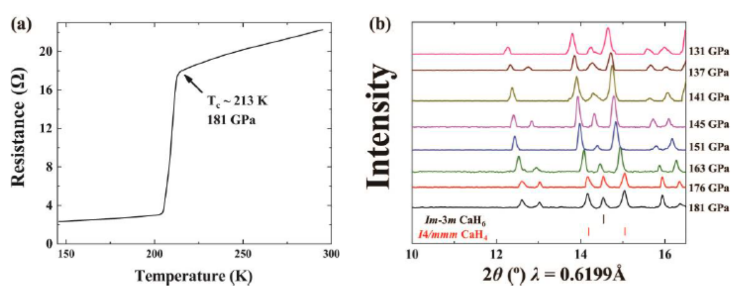


Fig. S3. (a) The superconducting transition at ~213 K was observed at 181 GPa (cell_2). (b) Experimental XRD patterns (cell_2) during decompression in the pressure range of 181 – 131 GPa.

f. The Temperature Range Below 100K Was Not Wrongly Omitted and is Not Misleading (Figure LuH 4 of Draft Report).

Additionally, the Investigation Committee raised concerns about the absence of 10 kbar data plotted all the way to 30 K. In Figure 2a, we specifically presented data up to 100 K, which aligns with what was submitted for publication. There is no obligation to display data beyond the range submitted for publication. Furthermore, when examining the phase below 100 K, significant noise is observed, likely attributed to interference. Consequently, due to compromised measurement quality, reporting data below 100 K is deemed unnecessary. On the contrary, the standard data processing steps and practices I outlined aim to uphold the integrity and significance of the original dataset. The data analysis methods do not inadvertently remove or alter any information crucial to the study's conclusions.

It came to my attention that there was an error in the LabView program which impacted the calculation of actual resistance values. The oversight involved omitting the multiplication of the Vrms value by the square root of 2. We later identified this issue and subsequently undertook the task of revising the entire set of LabVIEW programs and recalibrating the measuring instruments.

The data analysis processes described are standard practices in scientific research and not indicative of data fabrication or falsification. The Investigation Committee's oversight and misinterpretation of the AC electrical resistance data have resulted in a significant error in judgment. A thorough review of the data or an understanding of its background information could have prevented this situation. The Investigation Committee's hasty conclusion that I altered, resampled, and shifted the data is solely based on students' uninformed statements combined with a superficial examination of the signal's magnitude (voltage). Additionally, the Investigation Committee overlooked experimental limitations, raising concerns about their competency to accurately evaluate the data. This approach is notably inadequate for investigating a high-profile case with severe implications. The Investigation Committee's actions suggest a clear bias, indicating that their conclusions were predetermined and not founded on a thorough, objective analysis of the evidence.

g. The Published Data Have Not Been Altered and Resampled at 292K at 10kbar (Figure LuH 5 of Draft Report).

Let's address the accusations of data alteration and resampling. The Investigation Committee concluded that I intentionally resampled and altered the data. To clarify, I will present the raw data as recorded. Below is a figure (see Figure 26) depicting the magnitude (in black) and the published data from Figure 2a. This is a zoomed-in version the 10 kbar data to show the superconducting transition.

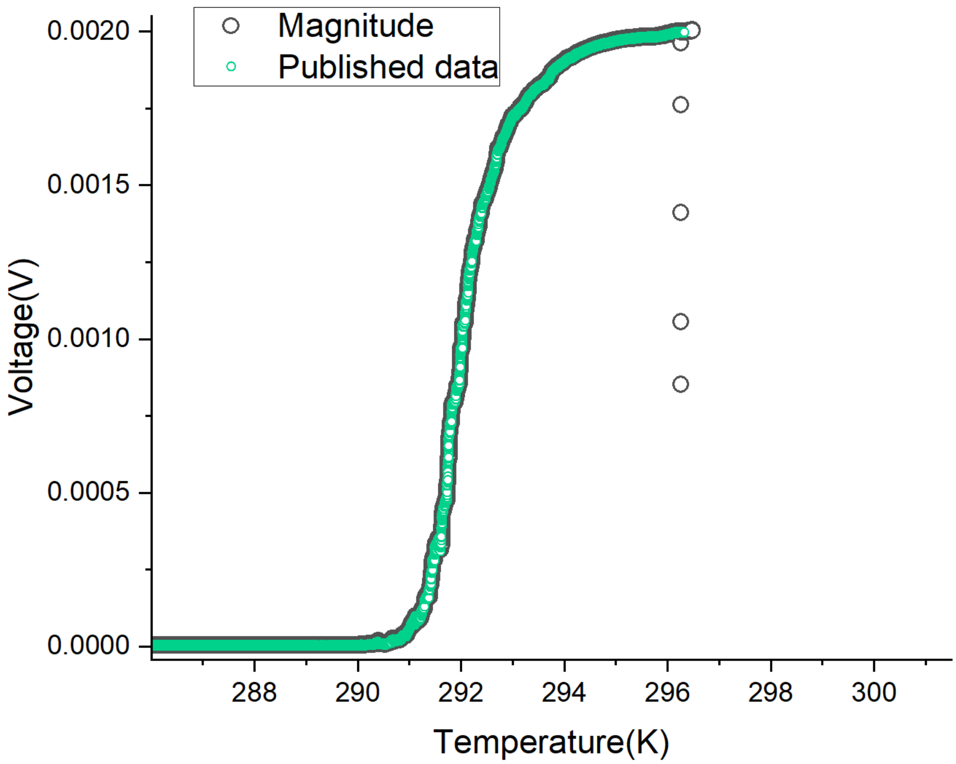


Figure 26. The magnitude of the recorded signal as a function of temperature during the superconducting transition at 10 kbar (black) with the published data in Fig. 2a of the Nature paper, represented by the green dots. As evident, the green curve aligns with the black curve.

The frequency-dependent resistance measurements reveal a presence of stray inductances, which results in a temperature dependent small offset. As can be observed, there is a small offset between the black and green data points. This necessitated a phase adjustment.

In addition, as explained above, this reactance introduces a phase shift, consequently altering the phase angle of the impedance (reactance component). This observation underscores the intricate interplay between the experimental setup and the intrinsic properties of the sample under high-pressure conditions. As described in the General Information No. 13 in Appendix I hereto, using magnitude (|ΔV|) to calculate resistance results in a positive offset, due to phase shift in zero-resistance materials like superconductors, scaling with noise levels. As SNR drops below 1, this offset increases. In a superconductor, where the voltage drops across the sample is zero which results in a, $SNR = \frac{\Delta V}{V_{noise}} \ll 1$ noise, regardless of the level of noise in the measurement. Consequently, using R =|ΔV| to calculate resistance results in values that are consistently clustered around an offset value proportional to the noise level of the measurement, which necessitates its removal. Thus, the observed difference because of the removal of this small offset voltage.

Following the phase adjustment, an observable discrepancy emerges when examining the Resistance data versus index. This disparity is particularly accentuated during the superconducting

drop, with less noticeable effects both before and after the transition. The Investigation Committee deliberately selected the temperature range coinciding with the superconducting transition to amplify this discrepancy induced by the phase adjustment. Figures 27 and 28 illustrate that the impact is less pronounced in the data both after and before the transition, in contrast to the Investigation Committee's depiction in the LuH_5 figure.

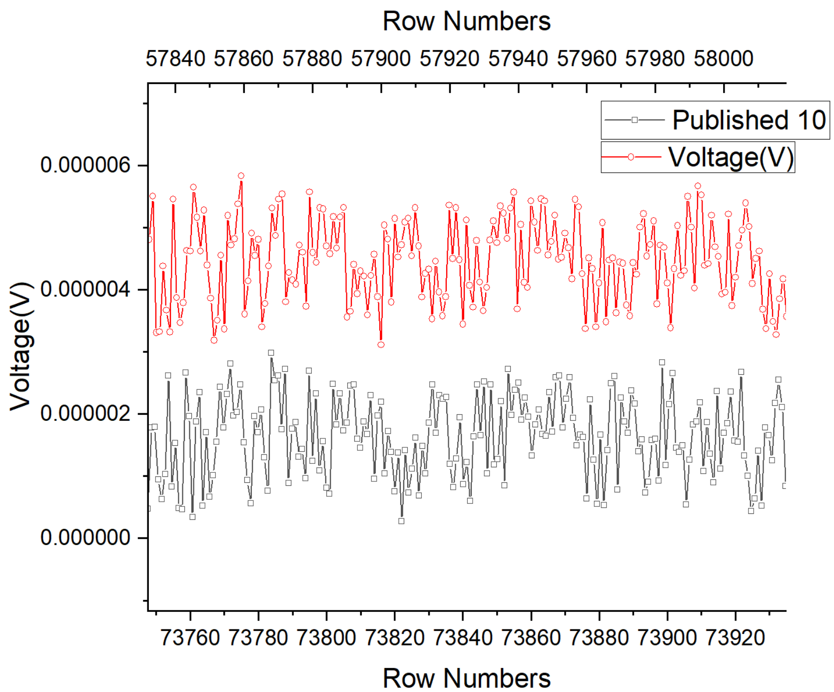


Figure 27. The Resistance data versus index on published data and recorded data after the superconducting transition at 10 kbar.

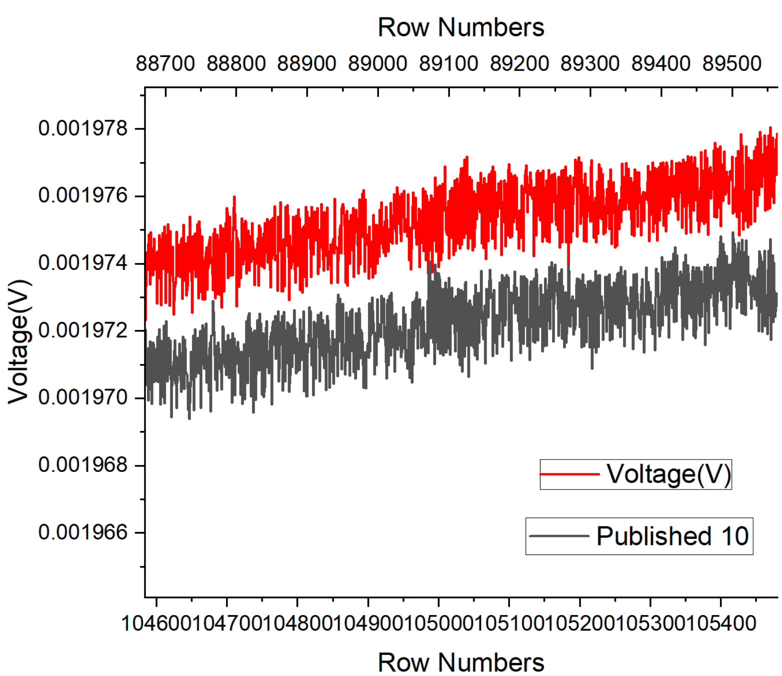


Figure 28. The Resistance data versus index on published data and recorded data before the superconducting transition at 10 kbar

The data analysis processes discussed above, specifically the offset removal, adhere to established standards in scientific research and should not be misconstrued as data fabrication or falsification. The observed discrepancies are solely attributable to the elimination of offset voltage. I wish to emphasize that the Investigation Committee's oversight and misinterpretation of the AC electrical resistance data have resulted in a significant error in judgment. Had the Investigation Committee meticulously reviewed the data or comprehended its contextual background, this error could have been averted. The swift conclusion reached by the Investigation Committee, asserting that I manipulated, resampled, and altered the data at 10 kbar, relies solely on the testimonies of students. This methodology is notably insufficient when investigating a case of such prominence, carrying potential severe consequences for my professional standing. The Investigation Committee's actions appear to exhibit a discernible bias, suggesting that their conclusions were preconceived and not rooted in a thorough, impartial analysis of the available evidence.

I have elucidated the scientific rationale behind the removal of offset voltage from the resistance data, detailing the measurement process and data analysis procedures. It is crucial to underscore that the employed data processing steps adhere to standard practices in the field and are not indicative of data fabrication or falsification.

The assertion made by the Investigation Committee that the objective of this process was to artificially demonstrate a zero-resistance state for the materials, referencing typical values for such measurements in the field, appears to lack a foundation in the understanding of superconductivity. Specifically, at the 10 kbar pressure point, the resistance values observed in the superconducting state were approximately in the range of 3-4 micro-ohms. It is worth noting that the Investigation Committee's expectations concerning resistance values during a superconducting transition remain somewhat unclear.

It is important to acknowledge that achieving a true zero resistance in superconductivity experiments presents a formidable challenge. Researchers frequently rely on qualitative changes, such as a significant shift in resistance, rather than obtaining an absolute zero reading, as a means of assessing superconducting behavior.

The removal of residual resistance is a necessary and common practice in high-pressure superconductivity studies. Resistance data alone do not suffice to conclusively establish superconductivity. Therefore, final data interpretations are routinely substantiated with other measurement techniques, including IV (current-voltage) curves, field-dependence studies, and magnetic susceptibility measurements.

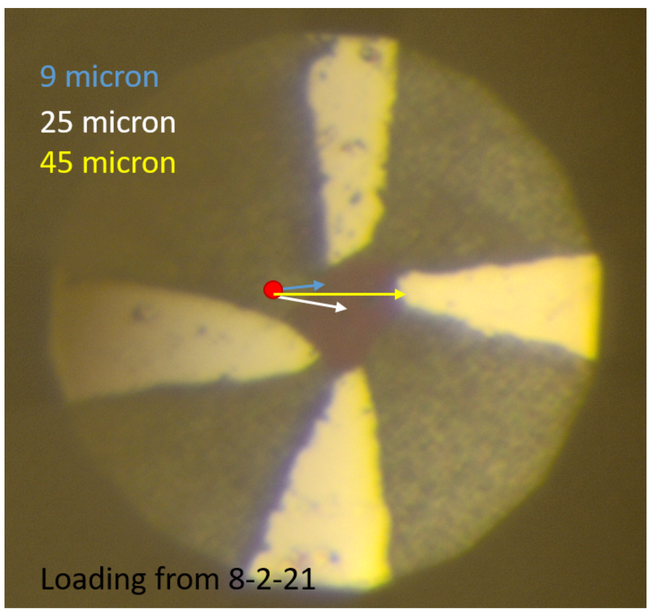
To provide context, I would like to reference examples of zero resistance states published in the high-pressure superconducting community. In these instances, none have demonstrated zero resistance, and their baseline values typically fall within the milli-Ohms range, significantly higher than our observations in the micro-Ohms range even without any offset removal. Hence, our data unequivocally indicates superconductivity, even without the removal of offset voltage, particularly when compared to data from other members in the community demonstrating the expected behavior in the superconducting state.

h. There was No Background Subtraction.

The Investigation Committee accused me of misleading the editors of Nature regarding the background subtraction in Figure 2a's data. I consistently maintain that no background subtraction was performed on the data in Figure 2a; rather, an offset value was removed. As clarified to the Nature editors, background subtraction was only carried out in EDF 15.

i. Figure 8 Pressure Correction Depiction.

The placement of the Ruby on sample was not directly on the sample; instead, it was pressed against the diamond powder we used to insulate the gasket. In the figure below, the red dot represents the Ruby sample, positioned 9 microns away from the nearest edge of the sample, 25 microns away from the middle, and 45 microns away from the far edge of the sample. We conducted a separate experiment to assess the pressure differences originating from various distances to the sample. This experimentation led to the conclusion that, in the above-mentioned sample, the actual pressure is approximately 2 kbar lower before 20 kbar and 2-3 kbar lower above 20 kbar. See below.



j. Conclusion to Response to Accusation No. 1.

In conclusion, a detailed examination of the R(T) data presented in Figure 2a of the Nature 2023 (LuHN) Paper demonstrates that the data was not falsified or fabricated. There are some respectful concerns regarding the Investigation Committee's approach, particularly their focus on additional columns in the sequestered data format rather than recognizing the identical nature of the raw data.

To provide clarity in the scientific discourse, I have respectfully explained the offset voltages and phase correction processes necessary for accurately interpreting high-pressure experimental data,

drawing upon examples from previous superconductivity studies on MgB2. It's important to note that the intent here is not to criticize but to provide context for the accusations related to the 20 kbar data. The emphasis is on clarifying that the data was not resampled nor shifted at 20 kbar, and there may have been a misunderstanding by the Investigation Committee in this regard. Furthermore, it's worth highlighting that the real part of the signal was used by the Investigation Committee in a manner that was not consistent with the original intent, which may have been an unintentional error on the part of the Investigation Committee, rather than any deliberate action.

The examination of the 16 kbar data further refutes accusations of fabrication or falsification, providing detailed insights into the experimental challenges and the need for offset voltage removal and phase adjustments. The explanation of offset voltage removal and the impact of stray inductance on measurements adds transparency to the data interpretation process.

Furthermore, I've justified the decision to present data up to 100 K, aligning it with the submission for publication and addressing concerns about noise interference below 100 K. The recognition of an error in the LabVIEW program setup, promptly identified and rectified by a knowledgeable graduate student, adds transparency to our process. I've scrutinized the Investigation Committee's accusations of intentional data alteration and resampling, presenting raw data and elucidating the impact of phase shifts and offset removal on resistance values. The discrepancies highlighted in the resistance data are attributed to the standard practice of eliminating offset voltage and are defended as routine procedures in scientific research. This appears to perhaps not be recognized by the Investigation Committee.

Crucially, my response underscores the necessity of considering other measurement techniques beyond resistance data alone to establish superconductivity conclusively. I have cited examples from the high-pressure superconducting community, highlighting the uniqueness of their observations, even without offset removal, in comparison to the milli-Ohms range typically seen in the field. My consistent denial of misleading regarding background subtraction and a detailed clarification regarding the placement of the Ruby on the sample address specific Investigation Committee accusations.

Throughout this response, the emphasis is on the importance of considering other measurement techniques beyond resistance data alone to conclusively establish superconductivity. Examples from the high-pressure superconducting community highlight the uniqueness of observations, even without offset removal, in comparison to the milli-Ohms range typically seen in the field. Any potential misleading behavior regarding background subtraction is firmly denied, and a detailed clarification regarding the placement of the Ruby on the sample is provided, addressing specific Investigation Committee accusations.

In conclusion, my commitment to the principles of scientific integrity and transparency remains unwavering. The goal here is not to challenge the Investigation Committee's findings out of arrogance but to encourage a more comprehensive review of the data and a deeper understanding of its contextual background, which may have helped avert the errors in judgment made by the Investigation Committee. Openness to further discussion and collaboration in the pursuit of scientific truth is emphasized.

* * *

2. Figure 13a, R(T) Data (Resistance as a Function of Temperature) Was Not Falsified nor Fabricated.

It must first be noted that the Investigation Committee's interpretation of the purpose of Fig. 13a is fundamentally flawed. The figure was not intended to show that a change in resistance between the superconducting state and the normal state occurs at the same temperature. This misinterpretation by the Investigation Committee reveals a general misunderstanding by the Investigation Committee that is fatal to the Investigation Committee's analysis and false accusations. Rather, the purpose of Fig. 13a is to demonstrate whether the transition is observable both upon cooling and warming. This is the crux of the matter, nothing more, nothing less. This aspect of our analysis was included in the paper in direct response to a request from a referee during the pre-publication peer review process. The question of whether the transition occurs under a magnetic field or not is simply not relevant in the context of Fig. 13a.

Next, the Investigation Committee's claim that "strong similarities indicate that the published data (green) were derived from the sequestered data (black)" is unequivocally false and may be perceived as intentionally misleading. The accusation of a derivation process with the data is baseless, as the published data and the recorded data file (referred to as 'sequestered data') are identical. There is no question of derivation; it is the exact same dataset. To suggest that the similarities are somehow indicative of manipulation is grossly misleading. In fact, this data set did not even undergo offset removal. To insinuate that the similarities suggest manipulation is misleading, especially when the data set did not undergo offset removal. The Investigation Committee's notion of a "derivation" appears designed to justify a presumption of wrongdoing, presenting a distorted interpretation of factual evidence that indicates the absence of falsification and/or fabrication of the data.

a. The Published Data Was Not Altered and Data Below 285K Was Not Wrongly Omitted (Figures LuH 10 and LuH 11 of Draft Report).

This accusation is completely unfounded and intentionally misleading. The rationale for plotting data only up to 285 K was to show whether the transition is observable both upon cooling and warming. It is generally recognized that superconductivity exhibits a transition from the normal state to the superconducting state at specific critical temperatures. In the pursuit of understanding and demonstrating superconducting transitions, researchers often focus on specific temperature ranges. It logically follows that a researcher attempting to show a superconducting transition at 285K with both warming and cooling may not necessarily address or rely on data below this temperature threshold. Therefore, the experimental setup is tailored to capture the behavior of the material during both warming and cooling precisely within this temperature range. Data collection and analysis are concentrated around the critical temperature to ensure accuracy and relevance to the intended study.

Temperatures below the critical temperature may introduce extraneous variables that could potentially confound the results. By restricting the study to the specific temperature range of interest, the researcher mitigates the influence of irrelevant factors, ensuring a more controlled and accurate examination of the superconducting transition. Such factors may in fact be the appropriate subjects of future research. For example, the understanding of grain boundaries,

percolation thresholds, and interaction between different phases, which can induce stress or strain on the superconducting phase that can alter its superconducting properties was intended for follow-up work and not within the scope of our original research.

Our initial research, which is the subject of the LuH paper, was specifically aimed at demonstrating our observation of a notable transition at 285K with both warming and cooling. Our research was focused and purposeful by concentrating on the critical temperature of 285K. This targeted strategy facilitated a comprehensive exploration of the transition dynamics while minimizing potential confounding factors and optimizing our resource utilization. It is not appropriate for the Investigation Committee to attempt to expand the scope of our research and then inappropriately claim that data was falsified and/or fabricated simply because data not relevant to the scope of our research was not utilized.

I have consistently confirmed that we generally do not collect cooling data as it tends to not be as reliable as warming data. Some of the challenges with relying on cooling data are that temperatures during cooling are not reliable, there can be significant deviation in pressure thereby rendering cooling data effectively meaningless, thermal hysteresis and asymmetry, and lack of consistency across experimental conditions. As such, we generally do not rely on cooling data. Instead, we rely more on warming data. The reason being that the reliability of warming data allows for a more robust and informative basis for understanding the intricacies of superconducting transitions.

By way of explanation, it is well known that superconducting transitions often exhibit thermal hysteresis, resulting in asymmetry between warming and cooling processes. Relying on warming data provides a more symmetrical view of the transition, allowing us to capture the complete picture without being affected by the inherent differences between the two phases.

It is generally recognized that natural warming data exhibits greater consistency across different experimental conditions. The influence of external factors, such as the rate of temperature change, interference, pressure change, temperature lag and noise, can be more reliably assessed during warming. This consistency enhances the reproducibility and generalizability of findings in superconductivity research. As such, relying on warming data proves to be a more reliable and informative approach in the study of superconducting transitions. The symmetry it offers, the comprehensive assessment of characteristics, the identification of anomalies, and the consistency across experimental conditions all contribute to the superior reliability of warming data.

With all the General Information in Appendix I hereto, it is clear that the Investigation Committee's fixation on cooling data is misplaced. Regarding this specific measurement, the only reason we included it is that the transition occurs at very high temperatures, around 294 K, where the lag between cooling and warming temperatures is minimal and pressure fluctuations are also less in that temperature range. Thus, using both cooling and warming data in this instance is accurate and demonstrates conclusively that the transition is observable under both cooling and warming conditions.

To further illustrate this point, I would like to present an example of measurements showcasing the superconductivity of Lu-H-N. As you can see in Figure 1, the significant difference in Tc

during cooling and warming reflects the inaccuracy of the cooling data temperature. due to the reasons mentioned above.

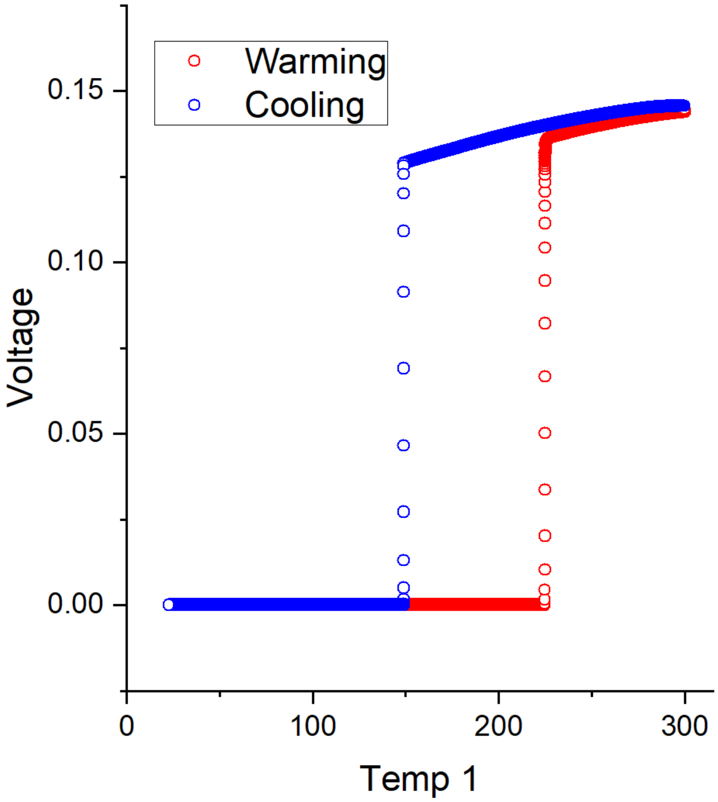


Figure 1. The cooling and warming data for a Lu-H-N superconducting sample at approximately 25 kbar show that, there is a significant difference of approximately 75 K between the transition temperatures (Tc) observed during the cooling and warming phases.

b. The Published Data Is Not the Result of a Faulty Electrical Connection (Figures LuH 12 and LuH 13 of Draft Report).

Next, let's address the accusation that the observed drop in resistance is due to a probe becoming loose. This accusation is not true and is refuted by the overwhelming evidence.

It is imperative to gain a thorough understanding of the sample's morphology when conducting research. This becomes particularly challenging in the case of highly inhomogeneous samples where the superconducting phase coexists with multiple other phases. Establishing effective contacts without introducing stray resistance emerges as a significant challenge in such scenarios.

In instances where the superconducting phase represents only a small portion of the overall sample, its inherent properties, such as the zero-resistance state, may face hindrances from the presence of other phases. The coexistence of multiple phases can complicate the measurement of the superconducting phase's characteristics.

The four-probe method, a widely used technique for measuring resistance, provides eight different configurations for experimentation. Under ideal conditions, these configurations should produce comparable results. However, in high-pressure experiments dealing with inhomogeneous samples,

this may not always hold true. The electrical properties of the non-superconducting phases have the potential to dominate the overall behavior of the sample, thereby influencing the measurement outcomes.

In essence, the challenge lies in ensuring accurate measurements in the presence of inhomogeneity. Researchers must be cognizant of the potential impact of coexisting phases on the superconducting phase's properties, particularly in scenarios where it constitutes only a fraction of the sample. This awareness is crucial for refining experimental methodologies, optimizing contact establishment, and enhancing the reliability of results in complex sample environments.

In the study of composite materials, the effective manifestation of a phase's bulk properties, such as superconductivity, often hinges on surpassing a specific percolation threshold. This threshold represents the minimum requirement for the phase to exhibit continuous presence throughout the sample. When the superconducting phase falls below this critical threshold, its distinctive properties may not be readily apparent. Consequently, the measurement conditions, encompassing variations in temperature, pressure, and applied magnetic fields, introduce complexities in accurately assessing the superconducting phase.

The impact of these measurement conditions can vary among the different phases present within the composite material, further complicating the task of precisely evaluating the superconducting phase. Notably, alterations in pressure during the cooling and warming stages may disrupt percolation thresholds, leading to dynamic changes in the sample's conductivity. This dynamic conductivity fluctuation poses a challenge in discerning the true characteristics of the superconducting phase.

The complexity of these interactions is visually illustrated in Figure 2, depicting an Electron Backscatter Diffraction (EBSD) mapping of the sample. This mapping reveals crucial information about grain orientation and microstructural variations within the composite material. The intricacies captured by the EBSD mapping emphasize the necessity for a nuanced understanding of the percolation thresholds and the dynamic nature of conductivity changes induced by varying measurement conditions.

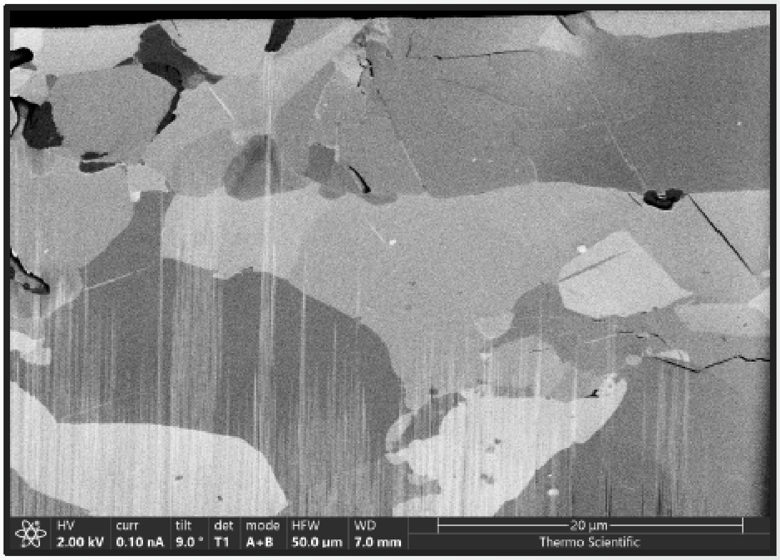


Figure 2. Electron image from the EBSD analysis, which shows the orientation of grains and grain boundaries of Lu-H-N sample.

Moreover, the intricate interplay between different phases within a composite material gives rise to complex electronic and structural properties, presenting challenges in straightforward interpretation. Notably, the stress or strain exerted by one phase on the superconducting phase can induce alterations in its superconducting properties. Similarly, variations in measurement conditions, including temperature, pressure fluctuations, and applied magnetic fields, can impart diverse impacts on the different phases coexisting within the sample.

The abrupt transitions observed between the normal and superconducting states can be attributed to the presence of multiple phases and variations among different grains. These variations undergo changes during the cooling and warming stages, influenced by pressure fluctuations that lead to a percolation effect. It is crucial to acknowledge that this behavior is not unique to our specific observations; indeed, experiments conducted by the Rus Hemley group demonstrated similar patterns in their LaH10 study and Lu-H-N replication.

Importantly, these transitions are not indicative of issues with probe connections, a factor that has been meticulously verified. The figure presented below (Fig. 3), extracted from the Hemley group's study, serves to further illustrate this phenomenon, emphasizing the broader applicability of the observed behavior in composite materials. This recognition underscores the need for a comprehensive understanding of the intricate dynamics between phases, providing a foundation for accurate interpretation and insightful analysis in superconductivity research. Unfortunately, it appears that the Investigation Committee lacks this necessary comprehensive understanding as it has misinterpreted the data.

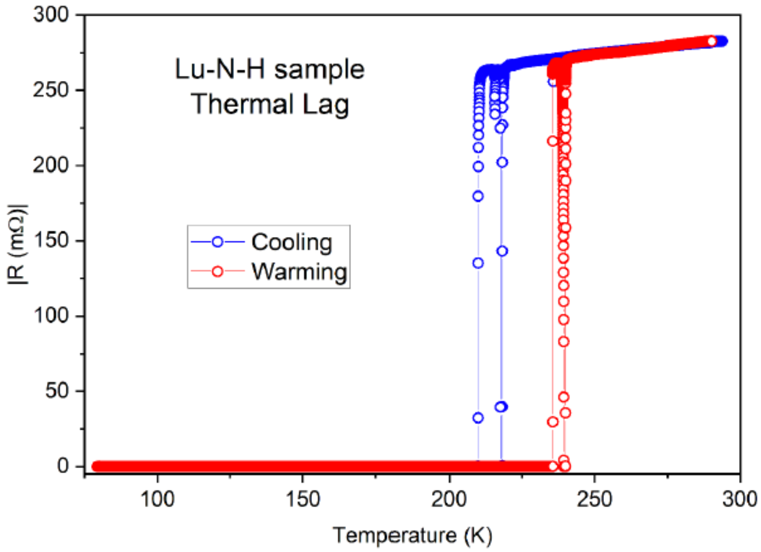


Figure 3. Comparison of the cooling and warming cycles at 8.5 kbar reveals a sudden change in resistance from the superconducting (SC) state to the normal state and then back from the normal state to the SC state.

To fortify the robustness of our research findings, we have recently implemented enhancements to our experimental setup. These improvements include the incorporation of a compliance limit for the current source and the addition of status notifications for the lock-in amplifier. The data showcased in the preceding Figure 1 were acquired utilizing this upgraded program.

As illustrated in Figure 4, the current source's status and the lock-in amplifier's status are prominently displayed and actively monitored. No issues or anomalies were detected during the experimental procedures, affirming the reliability and accuracy of the data obtained through our refined experimental setup.

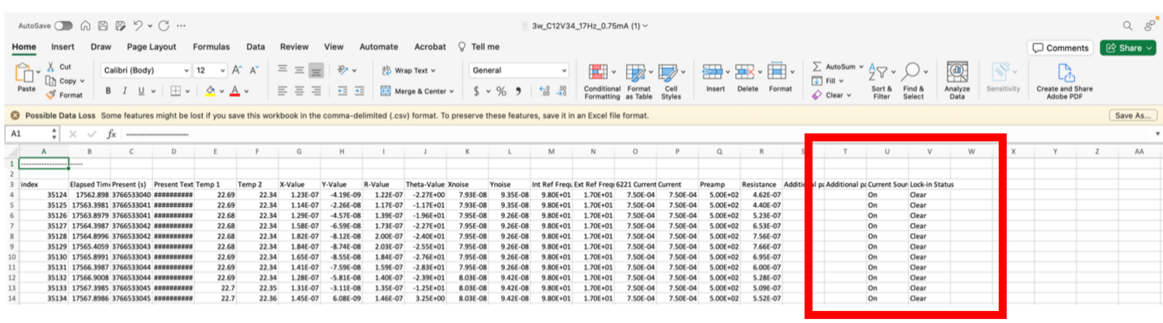


Figure 4. Screen shot of the data file of the Fig. 1 warming. The red box indicate the current source and lock-in status and they are not disconnected.

A fundamental procedure within this research framework is the two-terminal probe check, an essential step in ensuring the accuracy and reliability of resistance measurements. The two-terminal probe check involves a meticulous examination of the electrical connections between the

superconducting sample and the measuring instrument. This verification process ensures that the resistance measured is primarily associated with the superconducting material under investigation, without interference from extraneous factors such as poor electrical contacts or faulty connections. In our case, the data and information available to the Investigation Committee unequivocally demonstrate that Elliot Snider and Nathan Dassenbrock-Gammon, on separate occasions during the resistance study, each performed a two-terminal probe check. Two examples of these checks are shown below.

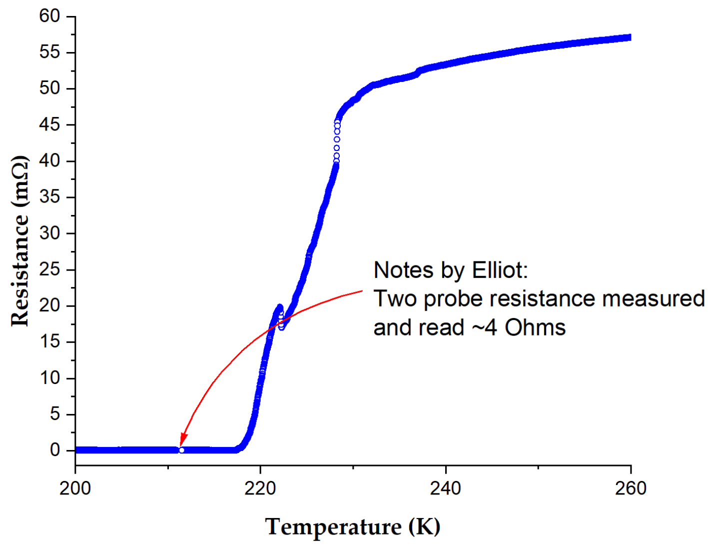


Figure 5. Temperature dependent resistance with a Tc of ~ 230 K. During the SC transition, Elliot had measured the resistance of the probes and they all worked.

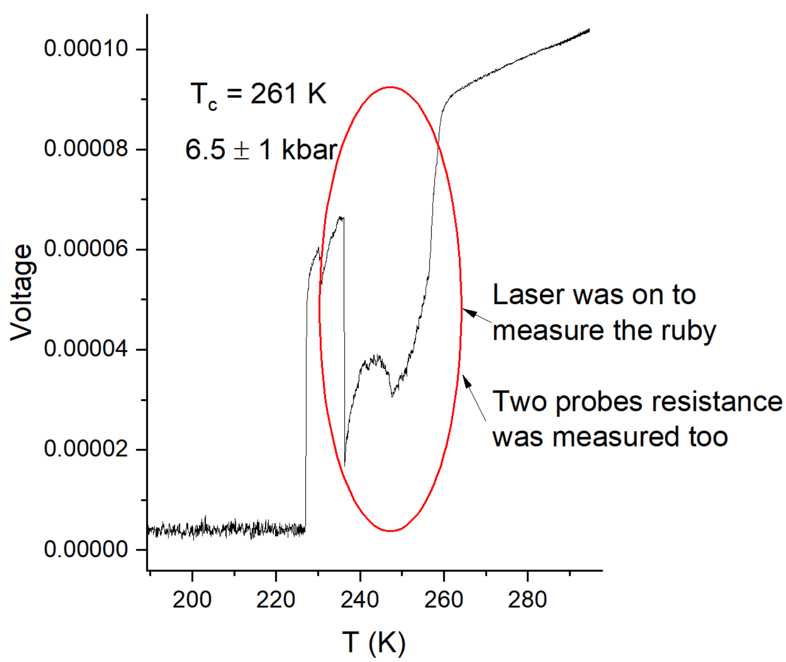


Figure 6. Temperature dependent resistance with a Tc of ~ 260 K. During the SC transition, Nathan and I measured the resistance of all was the probes and they all worked.

Figure 6 Screen shot of the notes from Elliot Snider.

11-5-21

Pressure remained 0.8GPa overnight (calcuated using kantor with 694.305nm as the ref which I collected while there were still fringes in the DAC on Ray's setup). The membrane held at 13PSI. Using the Keithley 6221 AC/DC current source and SRS SR860 Lock-in: 2mA, 13Hz, 500x preamp. Had to charge the system and started cooling at 10:45am. He told me to switch to 1mA, so I did, cooling hadn't begun yet.

219.19K blip is from me externally checking 2P 1-3 with handheld multimeter (masked out on plot). I wanted to make sure that the connection was actually reading and that there was no loss of probes. The 2P read ~4 Ohm. Visually there are some fringes and the pressure dropped which was the cause of my concern i.e. if the lead moved away from the tip.

Had to leave to run x-ray on sample and had Dylan take over. I added the continued cooling data (the continued cooling after F-70 was shut off) to the cooling book (column 11011 and onward)

Sharp increase in resistance at 270K on warmup is from me turning on the light. We watched it sharply increase.

Here, I provide a comprehensive examination of the evidence and data available to the Investigation Committee all of which supports the irrefutable conclusion that the observed resistance drop that we measured is not attributable to broken or disconnected probes:

In the event of a physically broken probe, it is implausible for it to be reattached without external reconnection. As such, the systematic pattern in the disconnection and reconnection of probes raises questions about the likelihood of broken probes. If the issue were related to broken probes, one would anticipate random occurrences rather than a pressure-dependent pattern.

Next, the expected characteristics of a resistance drop caused by a broken probe involve an abrupt transition with minimal data points. Contrary to this expectation, our measurements reveal approximately 50 to 100 data points, each captured with a time constant of 1 second. Even under testing conditions with a significantly shorter time constant, a substantial number of data points persist, indicating that the issue is not associated with broken probes.

Next, a broken probe would disrupt the lock-in amplifier's ability to synchronize with the reference signal, leading to chaotic phase behavior. Contrarily, our observations indicate that the lock-in remains securely synchronized, and the phase maintains stability as anticipated during a superconducting transition. This observed scenario contradicts the hypothesis of broken probes. Refer to Figure 7 below for visual representation.

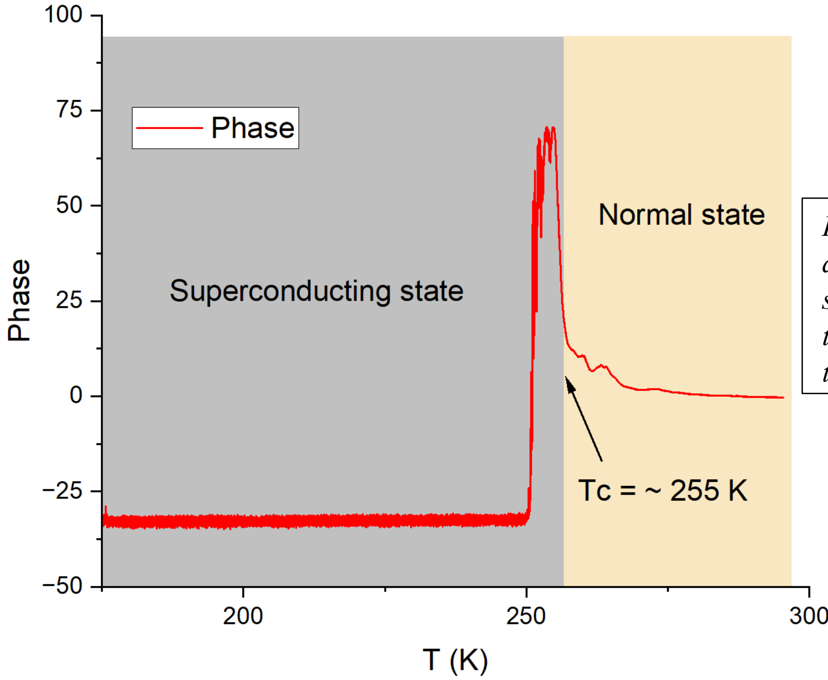


Figure 7. Phase change during the superconducting transition. The onset of the transition

The factual considerations outlined above strongly support the assertion that the measured resistance drops are not a consequence of broken or disconnected probes. The systematic patterns, the abundance of data points, and the stable behavior of the lock-in amplifier during superconducting transitions collectively indicate alternative causes for the observed phenomena.

Moreover, the evidence and data available to the Investigation Committee supports the conclusion that the observed nonlinear voltage-current (VI) relationships are not indicative of broken probes. More specifically, the presence of nonlinear VI relationships prompts the question of their origin. If a probe were indeed broken, one would anticipate an absence of any discernible relationship. In such a scenario, random noise in the measurements without any discernible current dependence would be the expected outcome. To the contrary, the data supporting our research aptly illustrates our findings, aligning with the anticipated behavior in a superconducting transition. See Fig. 8 below.

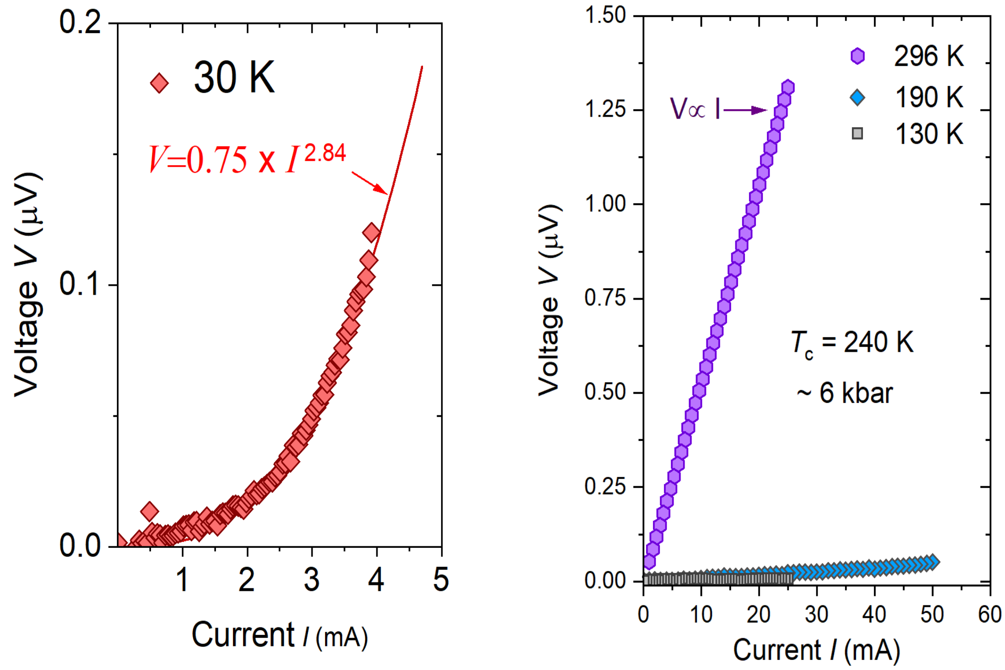


Figure 8. (Left): The VI (voltage-current) relationship during the superconducting transition. (Right): Shows the VI curves before and after the superconducting transition. Prior to the superconducting transition, a linear behavior is observed as expected, and following the transition, a non-linear behavior is evident, which expected a superconductor.

Equally significant is the evidence and data available to the Investigation Committee that supports the conclusion that the observed drops in resistance are not a result of broken probes.

The observation that two distinct types of measurements exhibit the same pressure dependence refutes the accusation that broken probes are responsible for the observed drops in resistance. Specifically, magnetic susceptibility, a definitive test for superconductivity, demonstrates the identical pressure dependence as observed in electrical resistance studies. If the resistance drops were indeed attributable to a faulty probe, one would not expect to discern any pattern or pressure dependence in the results. The consistency in pressure dependence observed in both types of measurements, as depicted in Figure 9, affirmatively dispels the notion of broken probes as the root cause of the observed phenomena.

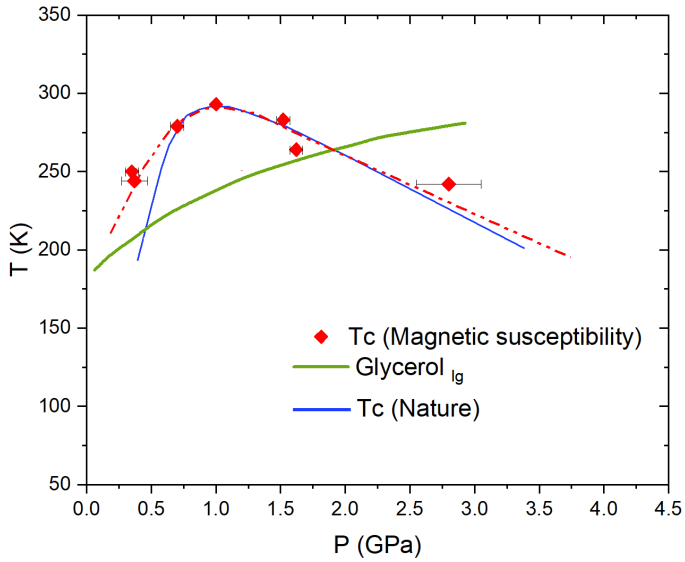


Figure 9. Pressure dependence of the transition temperature based on magnetic susceptibility studies. The green solid line is the glycerol condensation phase line.

In the pursuit of scientific truth, it is essential to approach one's experimental results with a combination of critical thinking and healthy skepticism. This approach serves as the foundation for validating the fundamental value of discoveries and preventing them from being mere outcomes of experimental anomalies. However, it is equally important to exercise caution and avoid hastily dismissing potentially significant findings solely based on an initial perception of being faulty.

To strike this delicate balance, a thorough examination of the results is imperative. Researchers should engage in reasoned analysis and integrate their findings into the broader scientific narrative. If initial observations appear discordant, rather than outright dismissal, it is an indication to delve deeper, seeking additional evidence until a coherent alignment emerges. This scientific approach emphasizes the necessity for every piece of knowledge to resonate within the larger picture. An observation that holds true in isolation but falters when placed in the wider context often signals a gap in our understanding.

The quest for scientific knowledge transcends the mere act of making discoveries; it extends to the meticulous weaving of these discoveries into the existing fabric of understanding. Ensuring that new findings contribute meaningfully to the collective wisdom of humanity is an integral aspect of the scientific endeavor. Ultimately, this approach underscores the responsibility to enrich our understanding not only by making new observations but also by integrating them seamlessly into the ever-evolving tapestry of scientific knowledge.

By way of example, I am going to share a story that illustrates the significance of embracing unexpected observations in scientific endeavors. The discovery of the superfluidity of Helium-3 (He-3) in 1972, ultimately earning the Nobel Prize in Physics, serves as a compelling example of the transformative power of thorough exploration.

In 1971, researchers Douglas D. Osheroff, David M. Lee, and Robert C. Richardson conducted a study on Helium-3 at extremely low temperatures near absolute zero at Cornell University.

Anticipating specific quantum mechanical behaviors, the researchers encountered unexpected effects as they cooled the Helium-3. Initially dismissed as mere "noise" in the data, Osheroff displayed a distinct approach by not overlooking these anomalies. Rather than disregarding them, he invested significant time in understanding the origin and nature of the observed "noise."

In the pursuit of scientific truth, the story of Helium-3 underscores the importance of ensuring that every piece of information fits into the larger framework. Despite initial appearances, Osheroff recognized that the observed anomalies indicated a phase transition in Helium-3. Ultimately, they discovered that at extremely low temperatures, Helium-3 transitions into a superfluid phase, characterized by a flow without viscosity or resistance. The Helium-3 story not only highlights the potential scientific breakthroughs that can arise from unexpected observations but also emphasizes the importance of avoiding an outcome-driven approach.

Drawing parallels to our current discussion, the temptation to dismiss observed issues as merely a result of a broken probe may offer a facile resolution. However, it prompts the question of whether such a conclusion aligns with the collective results and resonates within the broader scientific narrative. Unfortunately, the current discourse sheds light on a failure in critical thinking among a few students in my group and seemingly adopted by the Investigation Committee.

At the time of submitting the paper, I lacked a comprehensive understanding of the intricacies surrounding this sample. However, subsequent developments have illuminated a crucial aspect, as depicted in Figure 10. We now have a clear understanding of the specific stoichiometry responsible for achieving high critical temperatures (Tc) in superconductivity. Notably, LuH2.2N0.72 exhibits a Tc exceeding 200 K, as evidenced in the figure. Moreover, Figure 11 illustrates the stability of this composition.

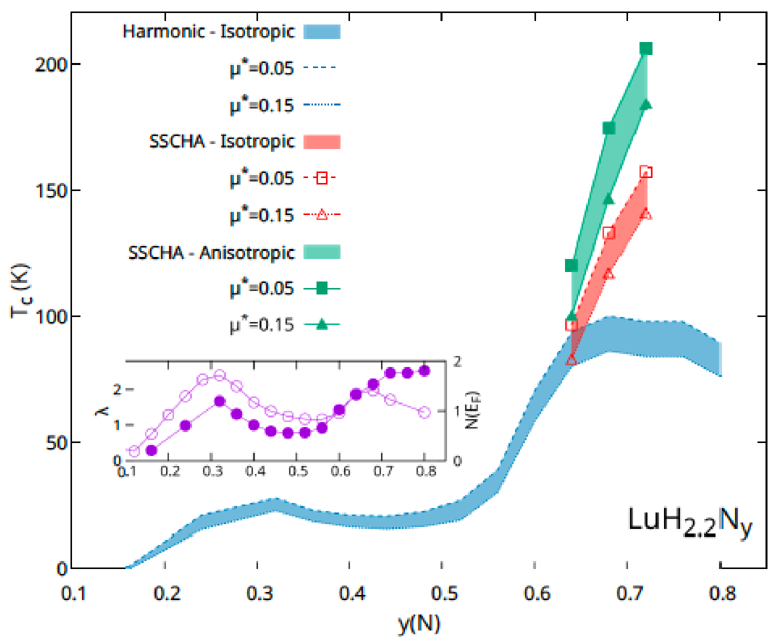


Figure 10. Superconducting critical temperature (Tc) as a function of Nitrogen doping content (y(N)) for LuH2.2Nx at 1 GPa. It shows Tc calculated from the isotropic (dashed lines) and anisotropic (solid lines) ME equations. The inset shows with filled circles the electron-phonon parameter (λ) and the density of states at EF (N (EF)) with open circles within the harmonic approximation as a function of y(N).

The structural configuration accountable for the observed superconductivity can be precisely defined as LuH2, situated in tetrahedral positions, accompanied by H0.2 and N0.72 occupying

octahedral positions. While LuH2 in tetrahedral coordination exhibits inherent stability, the introduction of hydrogen (H) and nitrogen (N) into octahedral positions presents a notable challenge. Achieving superconductivity necessitates a meticulous balance of H, N, and vacancies, particularly within octahedral sites. Any deviation from this precise stoichiometry results in the loss of high critical temperature (Tc) superconductivity.

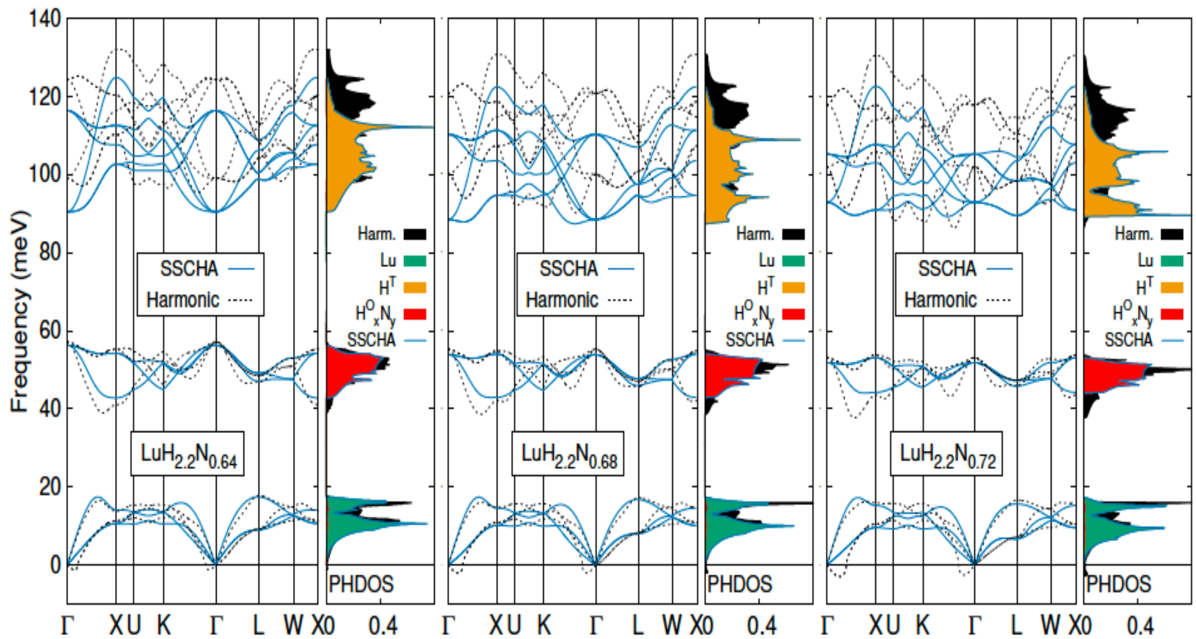


Figure 11. Phonon dispersion, total and projected phonon density of states calculated for LuH2.2N0.64 (a), LuH2.2N0.68 (b), and LuH2.2N0.72 (c) at 1 GPa. Solid and dashed lines represent the SSCHA and harmonic DFPT calculations, respectively.

Compounding this complexity is the dynamic stability inherent to octahedral sites. The transition of hydrogen atoms from these positions can easily occur, leading to the cessation of superconducting properties. This dynamic process is more pronounced at lower pressures, where the stability of atoms in octahedral positions is less assured. Conversely, higher pressures secure these atoms in place, thereby contributing to the stabilization of the superconducting phase. Consequently, the dynamic behavior of hydrogen in octahedral sites emerges as a critical factor influencing the observed transitions between superconducting and non-superconducting states in resistance measurements.

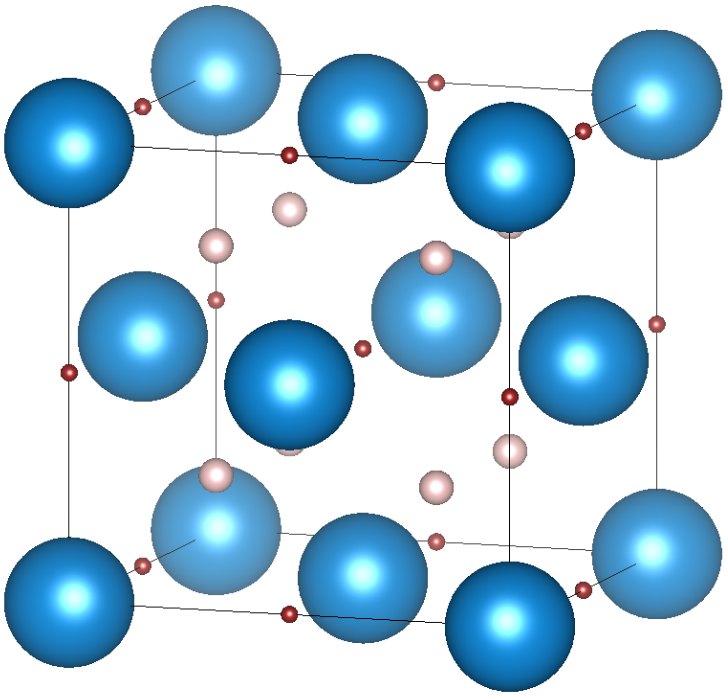


Figure 12. Crystal structure of the superconducting Lu-H-N system. The blue spheres represent the Lu atoms at 4a positions, the gray spheres represent the H in tetrahedral potions, and maroon spheres represent the octahedral

c. Conclusion in Response to Accusation No. 2.

In conclusion to this section of the response, it is crucial to emphasize that Figure 13a, representing the R(T) data (Resistance as a Function of Temperature), was neither falsified nor fabricated. The Investigation Committee's flawed interpretation of the figure's purpose, attributing it to show a change in resistance occurring at the same temperature, reveals a fundamental misunderstanding. The figure aimed to demonstrate the observability of the transition upon cooling and warming, not the specific temperature at which it occurs. This misinterpretation by the Investigation Committee undermines their analysis and raises concerns about the accuracy of their accusations.

The claim that the published data was derived from the sequestered data is unequivocally false and may be perceived as intentionally misleading. The accusation of derivation is baseless, as the published and sequestered data are identical. To suggest manipulation based on similarities is misleading, especially when the dataset did not undergo offset removal. The Investigation Committee's notion of "derivation" appears designed to justify a presumption of wrongdoing, presenting a distorted interpretation of evidence that indicates the absence of falsification or fabrication.

The rationale for plotting data only up to 285 K was to focus on the critical temperature range for a comprehensive exploration of the superconducting transition. The Investigation Committee's attempt to expand the scope of the research and claim data falsification based on omitted points below 285 K is inappropriate. The emphasis on warming data is justified by its reliability, symmetry, and consistency across experimental conditions.

The accusation that the observed drop in resistance is due to a probe becoming loose is refuted by overwhelming evidence. The intricacies of inhomogeneous samples, percolation thresholds, and dynamic conductivity changes under varying conditions are essential considerations. The Investigation Committee's misinterpretation of data and failure to comprehend these complexities raise questions about their understanding. The evidence presented, including two-terminal probe checks and comparison with magnetic susceptibility measurements, strongly disputes the notion of broken probes.

In the pursuit of scientific truth, it is imperative to approach unexpected observations with critical thinking and skepticism. The comparison to the discovery of Helium-3 superfluidity illustrates the transformative power of thorough exploration. The narrative underscores the importance of avoiding an outcome-driven approach and encourages a comprehensive understanding of observed phenomena.

In summary, the evidence and data available refute the Investigation Committee's accusations, highlighting the integrity of the research findings. The misinterpretations, flawed assumptions, and lack of understanding demonstrated by the Investigation Committee underscore the need for a more nuanced and informed analysis.

* * *

3. Extended Data Figure 15, R(T) Data (Resistance as a Function of Temperature) Was Not Fabricated nor Falsified.

In addressing the Investigation Committee's assertions regarding our research, specifically concerning the R(T) data referenced in Extended Data Figure 15, we aim to provide clarity on certain points for a more accurate understanding of our work.

The Investigation Committee suggests that data falsification occurred to mislead editors and peer reviewers regarding the R(T) data in Extended Data Figure 15. It is imperative to underline that Extended Data Figure 15 did not play a supporting role in the findings presented in our Nature 2023 paper. None of the data, parameters, or conclusions derived from Extended Data Figure 15 were referenced or utilized in the main body of the paper. Contrary to the Investigation Committee's implication, there was no data falsification, and our intent was not to mislead editors or peer reviewers during the pre-publication peer review process by not providing raw data or making it available. Our commitment to upholding the highest standards of integrity remains unwavering, and we find these allegations inconsistent with the principles guiding our research. It is essential to recognize that the Investigation Committee's conclusion lacks credibility in this regard.

While acknowledging the significance of the pre-publication peer review process in scientific publishing, it is customary for researchers to refrain from the immediate availability of raw data during this phase. Valid reasons for this practice include the protection of intellectual property, considering the substantial investment of time, resources, and effort in conducting experiments.

Additionally, during the early stages of research, data may be incomplete or not fully understood. The iterative nature of the research process involves refining methodologies and analyses based on feedback from peer reviewers. Premature dissemination of incomplete or not understood data can lead to misinterpretations and impact the overall rigor of the research.

Despite this customary practice, we proactively expressed our willingness to provide data to the referees if requested by the editors. Consequently, the data was readily accessible during the review process, underscoring our commitment to transparency.

The Investigation Committee's conclusion lacks credibility in the specific context of data falsification and misleading practices during the pre-publication peer review process. This response is provided with the aim of addressing the Investigation Committee's concerns and ensuring a more accurate representation of our research.

a. The Tick Labels on the Vertical Axis Plot are Not Incorrect.

The Investigation Committee's assertion that "[t]he tick labels of the vertical axis plot of the data in voltage are obviously incorrect: dividing 0.020 Volts, the span of the voltage scale, by 0.002 Amperes yields R=10 Ohm, not 10 mOhm as shown on the plot on the right" is quite remarkable. In response to the Investigation Committee's assertion regarding the tick labels on the vertical axis plot of voltage data, it is imperative to address the inaccuracies present in their statement. This statement reflects a misunderstanding on the part of the Investigation Committee, potentially stemming from either inexperience or a biased interpretation of the data. Contrary to their assertion, the voltage values were measured in millivolts, not volts, a crucial detail overlooked in their analysis.

By dividing 0.020 Volts by 0.002 Amperes, the result is indeed a resistance of 10 mOhms, consistent with the representation on the plot. The Investigation Committee's claim that the voltage values are incorrect fails to acknowledge this fundamental fact. The voltage measurements are accurate, and there is no discrepancy in their representation on the plot. It appears to me that there is an purposeful effort to identify issues in order to justify a predetermined outcome.

It is essential to recognize that the Investigation Committee's conclusion lacks credibility and is based on a misinterpretation of the measurement units involved. The representation of the data adheres to industry standards, and any suggestion of wrongdoing is unfounded.

b. EDF 15_RvsT_ Was Available During Pre-Publication Peer Review.

Another telling example of the Investigation Committee's purposeful efforts to create the appearance of wrongdoing where no such wrongdoing exists is their statement that "[i]t is likely that the file EDF15_RvsT_Magnetic Field Studies.csv was not made available to pre-publication reviewers. This would explain why pre-publication reviewers did not express similar concerns…" This assertion is factually not true and further demonstrates the Investigation Committee's outcome driven preconceived biased and prejudicial judgment.

The Investigation Committee, without delving into the details or seeking further information, prematurely concluded that I did not provide certain data to Nature pre-publication. The Investigation Committee's untrue assertion led to their conclusion that the RvsT questions were not addressed during the pre-publication peer review process. Below are email communications with the pre-publication editors that clearly demonstrate that the RvsT data was provided to the pre-publication editors and peer reviewers during the pre-publication peer review process.

Gmail — Ranga Prabhashwara <rangadiaz@gmail.com>

Revised manuscript and the response to the referee's

Tobias Roedel <tobias.roedel@nature.com> — Fri, Aug 5, 2022 at 6:21 PM
To: Ranga Dias <rangadiaz@gmail.com>

Dear Ranga,

One of our referees requested the raw data for the following figures:

- Fig. 2c, main panel: R(T) and R_c(T) for three values of magnetic field, without normalization and without subtraction.

- Extended Data Fig. 5 real part of susceptibility vs temperature without any subtraction / averaging, etc. If possible the imaginary part of susceptibility vs. temperature from the same run.

Can you please send me the requested data as soon as possible? Apologies if you already submitted part of the data with the original version of the manuscript.

Best regards

Tobias

From: Ranga Dias <rangadiaz@gmail.com>
Sent: Tuesday, August 2, 2022 2:45 PM
To: Tobias Roedel <tobias.roedel@nature.com>

arl

Gmail — Ranga Prabhashwara <rangadiaz@gmail.com>

Revised manuscript and the response to the referee's

Ranga Dias <rangadiaz@gmail.com> — Sat, Aug 6, 2022 at 2:38 AM
To: Tobias Roedel <tobias.roedel@nature.com>
Bcc: Robert Heist <rconnorh@rconnorlaw.com>, Ashkan Salamat <ashsalamat@gmail.com>

Dear Tobias,

Please find attached the data files for Fig 2c and ExtendedData Fig 5. Is it possible for us to know which referee (Ref 1, 2, 3, or 4?) requested this data?

Have a nice weekend.

Thanks,
Ranga
[Quoted text hidden]

---

2 attachments

Extended Data Fig5.csv
91K

Fig2c_RvsT_Magnetic Field Studies.csv
1928K

The email communications unequivocally demonstrate the prompt provision of requested data to the main referee. Notably, Nature's senior editors informed us of consulting four referees, with the main referee being a distinguished expert in superconductivity, possessing extensive experience in experimental backgrounds related to superconductivity. The invaluable conclusions and suggestions provided by the main referee played a pivotal role in effecting significant revisions to our manuscript.

Throughout the peer-review process, the main referee meticulously analyzed the data with and without background subtraction, sharing insights with other referees in subsequent review rounds. The feedback received from all referees contributed significantly to enhancing the manuscript's quality, prompting us to revise it in accordance with their valuable suggestions. Please note that in the original submission, the field studies were in Figure 2a. As a result of the referee's suggestions, we have relocated the figure to EDF 15.

It is evident from the peer-review discussions that there were no concerns raised by the referees regarding the data or the subtraction method, considering it a standard practice in the field of high-pressure superconductivity.

c. There Was No Background Subtraction, There Was an Appropriate Offset Removal.

Field-dependent resistance measurements, a secondary method for observing superconductivity, are crucial, especially when primary measurements like susceptibility or heat capacity are challenging or impossible under extreme pressures. As noted in the response to Fig 2a, achieving zero resistance in high-pressure studies is not straightforward.

The accuracy of zero resistance measurement depends on instrument sensitivity. While DC resistivity in a superconductor is established as zero at ambient pressure, the scenario changes in AC resistance or under the influence of an applied magnetic field. Normal electron or quasiparticle resistive behavior, not eliminated by cooper pairs in DC measurements, persists at finite frequencies. Additionally, quantized flux lines' motion in the mixed state of a type II superconductor can lead to energy dissipation, resulting in finite resistance. The 'zero resistance' characteristic is context-specific, discussing magnetic fields and zero frequency of the applied electric field. In high-pressure experiments, true zero resistance remains elusive even with the DC method, with observed fluctuations near zero. This fluctuation can be considered effectively zero, typically up to five to six decimal points. This phenomenon is not unique to high-pressure studies but is observed in conventional conditions as well.

In dealing with highly inhomogeneous samples, establishing effective contacts without introducing stray resistance poses challenges. The superconducting phase, constituting only a small part of the sample, may have its zero-resistance state hindered by other phases. In the four-probe method, all configurations should ideally yield comparable results, but in high-pressure experiments, non-superconducting phases can dominate, masking or overshadowing the superconducting transition. Some configurations might not record zero resistance, or they might show higher residual resistance below Tc. Subtraction of temperature-dependent residual

resistance is a standard practice in such scenarios, supported by other measurement techniques like magnetic susceptibility.

Referring to a landmark paper by Somayazulu et al. on hydride superconductivity, their resistance studies indicated significant residual resistance. This paper on LaH10 was a pioneering demonstration of high Tc superconductivity near room temperature in a clathrate-based metal hydride. After subtracting the background, zero resistance was revealed. As illustrated in Fig.1 below, the temperature-dependent resistance measurement indicates significant residual resistance in the top figure. The bottom figure, however, shows the results after subtracting the background (denoted as Rc), revealing zero resistance. If the Investigation Committee's assertion were accepted, this paper, along with many others, would be considered as falsifying or fabricating data. However, this demonstrates that background subtraction is a standard procedure in the field, followed by numerous researchers. This practice is essential for accurate data interpretation, underscoring its validity.


PHYSICAL REVIEW LETTERS

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Featured in Physics Editors' Suggestion

Evidence for Superconductivity above 260 K in Lanthanum Superhydride at Megabar Pressures

Maddury Somayazulu, Muhtar Ahart, Ajay K. Mishra, Zachary M. Geballe, Maria Baldini, Yue Meng, Viktor V. Struzhkin, and Russell J. Hemley
Phys. Rev. Lett. **122**, 027001 – Published 14 January 2019

Physics See Viewpoint: Pushing Towards Room-Temperature Superconductivity

Article References Citing Articles (665) Supplemental Material PDF HTML Export Citation

ABSTRACT

Recent predictions and experimental observations of high T_c superconductivity in hydrogen-rich materials at very high pressures are driving the search for superconductivity in the vicinity of room temperature. We have developed a novel preparation technique that is optimally suited for megabar pressure syntheses of superhydrides using modulated laser heating while maintaining the integrity of sample-probe contacts for electrical transport measurements to 200 GPa. We detail the synthesis and characterization of lanthanum superhydride samples, including four-probe electrical transport measurements that display significant drops in resistivity on cooling up to 260 K and 180–200 GPa, and resistivity transitions at both lower and higher temperatures in other experiments. Additional current-voltage measurements, critical current estimates, and low-temperature x-ray diffraction are also obtained. We suggest that the transitions represent signatures of superconductivity to near room temperature in phases of lanthanum superhydride, in good agreement with density functional structure search and BCS theory calculations.

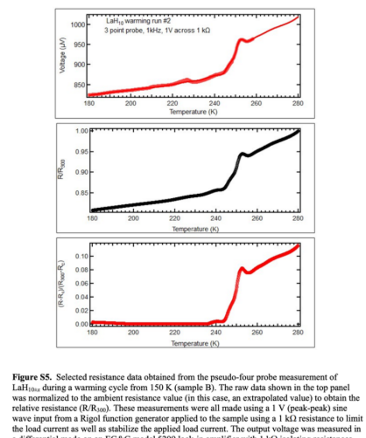
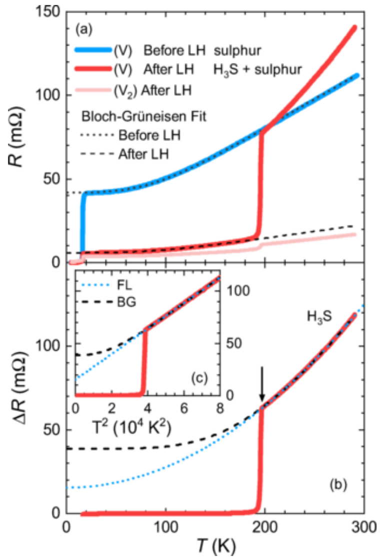


Figure S5. Selected resistance data obtained from the pseudo-four probe measurement of $LaH_{10\pm x}$ during a warming cycle from 150 K (sample B). The raw data shown in the top panel was normalized to the ambient resistance value (in this case, an extrapolated value) to obtain the relative resistance (R/R_{300}). These measurements were all made using a 1 V (peak-peak) sine wave input from a Rigol function generator applied to the sample using a 1 kΩ resistance to limit the load current as well as stabilize the applied load current. The output voltage was measured in a differential mode on an EG&G model 5209 lock-in amplifier with 1 kΩ isolating resistances

Fig. 1. The resistance vs temperature data under pressure during the superconducting transition on LaH10.

Another example was the first ever independent verification of H_3S superconductivity at 200K. after 7 years from the discovery. See this reference: Osmond et al [Phys. Rev. B 105, L220502 (2022)](), which demonstrates the subtraction of residual resistance. At 200 K the resistance was ~ 20 mOhms.



Osmond et al subtracted out the residual resistance from elemental sulfur using the relationship below:

$$R(T) = R_0 + B\left(\frac{T}{\Theta_D}\right)^n \int_0^{\Theta_D/T} \frac{z^n dz}{(e^z - 1)(1 - e^{-z})} \quad (1)$$

If the Investigation Committee's assertion is to be taken as correct, then, by their logic, this paper would also be considered as having falsified or fabricated data. However, what this actually demonstrates is that background subtraction is a standard procedure in this field, one that has been followed by many researchers.

The same procedure is also followed and denoted in a third notable example: Kong et al, *Nature Communications* 12, 075 (2021) https://www.nature.com/articles/s41467-021-25372-2.

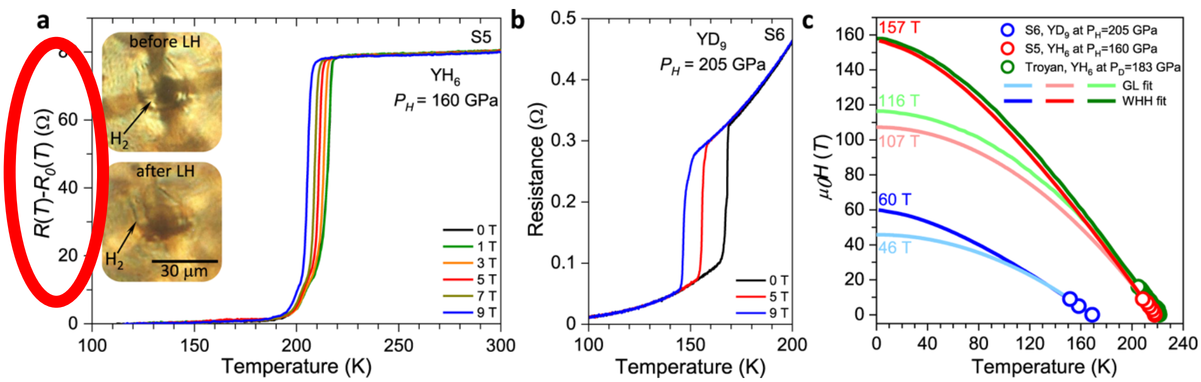


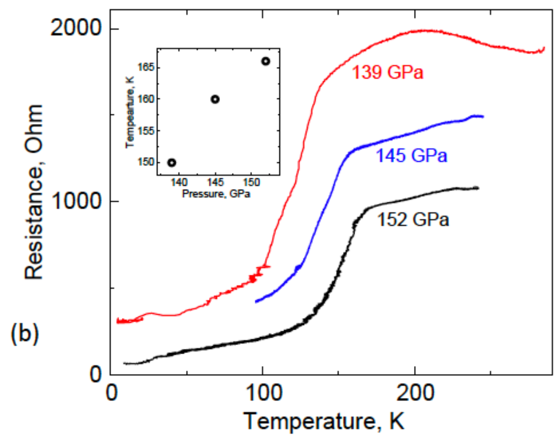
Fig. 3. The resistance vs temperature data under pressure during the superconducting transition on YH9.

The above Fig 3(a) the field dependent resistance was subtracted out a residual resistance, denoted as $R_0(T)$. Also Fig. b shown above has a broad transition without observing zero resistance. The residual resistance at 100 K is ~ 25 mOhms. Again, If the Investigation Committee's assertion is to be taken as correct, then, by their logic, this paper would also be considered as having falsified or fabricated data. However, what this demonstrates is that background subtraction is a standard procedure in this field, one that has been followed by many researchers.

In our experiment, we subtracted out the residual resistance contributed by the other, semi metallic, semi-conducting phases which is not superconducting. Moreover, the pressure gradient of the

DAC was significant, which causes the transition to be broader. The pressure dependence of T_c here is ~18 K $kbar^{-1}$. Therefore, observed broadening can be explained as being a response to pressure gradients.

Another example by Drozdove et. al., an iconic paper of LaH10 replication after the first observation by Somayazulu et al. You can see the broad transition without resistance going to zero. In order to show resistance goes to zero, you have to subtract out the residual resistance.



More examples are shown below.

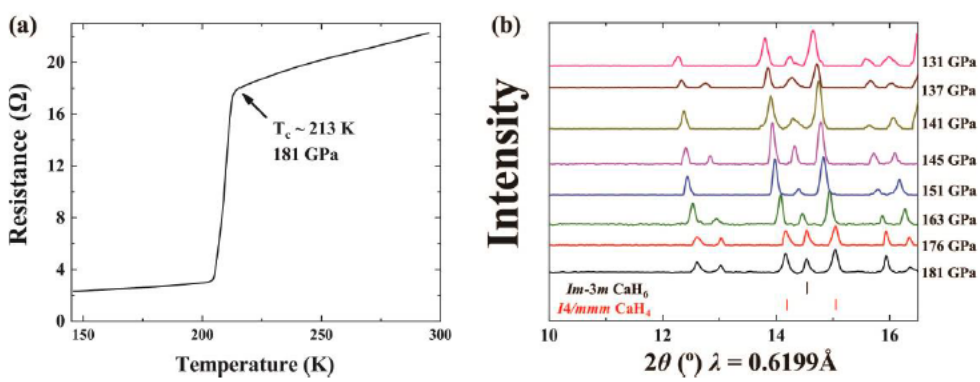


Fig. S3. (a) The superconducting transition at ~213 K was observed at 181 GPa (cell_2). (b) Experimental XRD patterns (cell_2) during decompression in the pressure range of 181 – 131 GPa.

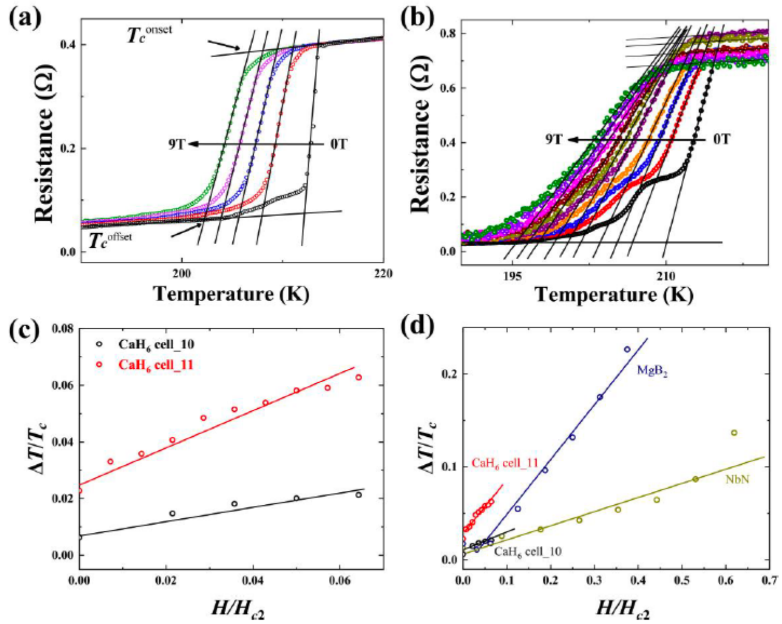


Fig. S9. (a) and (b) Temperature dependence of the electrical resistance under applied magnetic fields measured from cell_10 and cell_11, respectively. The transition width is determined by $\Delta T = T_c^{onset} - T_c^{offset}$, where T_c^{onset} and T_c^{offset} are defined as the intersection of the extension line (black line) of the transition curve [5] and the

Should the Investigation Committee's unsupported allegations be acknowledged, it implies that every high-pressure paper published by scientists in this field is founded on fabricated or falsified data derived from field-dependent resistance studies.

d. The Fit Coefficients for 0T, 1T, and 3T are Correct.

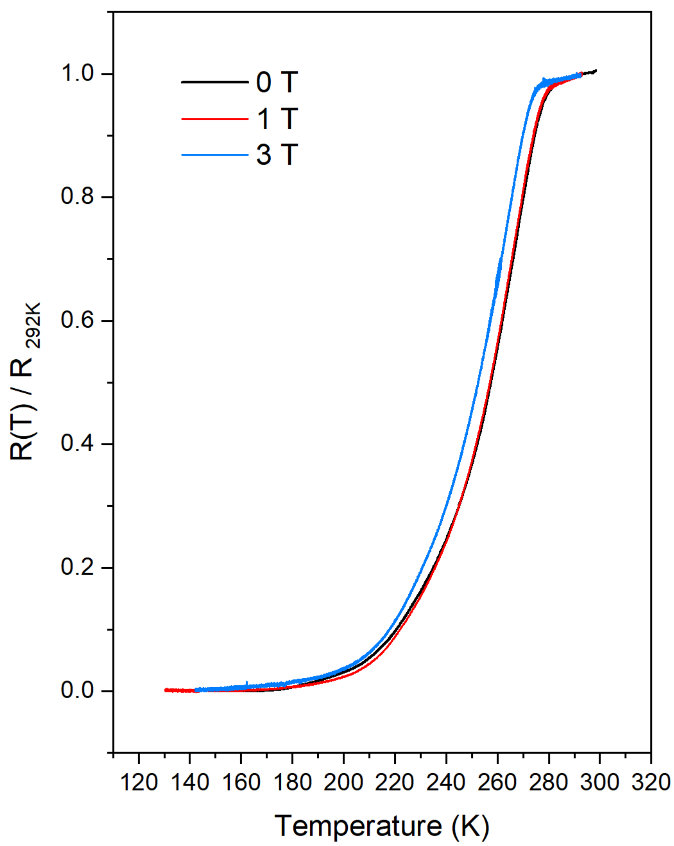
Let's examine the temperature dependence residual resistance equation employed in this study: $R(T) = R_o + aT^2 + bT^5$, fitted to data below T < 220 K for each field.

The selection of a residual resistance is generally rooted in low-temperature metallic behavior. In the context of electron-phonon contribution to electrical resistance in metals, described by the Bloch-Grüneisen formula, the T^5 term represents electron-phonon interaction, reflecting the strength of conduction electron scattering by lattice vibrations (phonons). This scattering intensifies with increasing temperature, leading to a rise in resistance. At low temperatures, electron-phonon interaction dominates resistance in metals as phonons become more populated, causing increased scattering and higher resistance.

A negative coefficient for T^5 would imply decreasing resistance with increasing temperature due to electron-phonon interactions, contrary to metallic behavior. Above the Debye temperature (typically around 200 K for many metals), electrical resistance due to electron-phonon interactions transitions to linear temperature dependence ($R(T) = R_0 + aT$ or $R_0 + aT^2$) from the T^5 dependence observed at lower temperatures. In our case, the highly inhomogeneous sample with multiple

phases ranging from metals to semiconductors complicates treating the temperature-dependent resistance solely as metals especially in the case of temperature dependence resistance coming out of non-superconducting regions. Despite using the $R(T) = R_0 + aT^2 + bT^5$ formula, the T^5 coefficient is insignificantly small (order of 10^{-15}), reflecting linear temperature dependence rather than the T^5 dependence observed at lower temperatures. Although the coefficient we used was negative, it was almost essentially negligible and what we were fitting was $R(T)=R_0+aT^2$, which very well defines and explains the low temperature (close to room temperature side) residual resistance behavior.

Our focus is on resistance behavior post-superconducting transition in this highly inhomogeneous sample. The unconventional coefficients do not undermine the core objective. Even without background subtraction or using a linear model, our primary interest remains unchanged – observing the shift in critical temperature (Tc) with an applied magnetic field, a discernible phenomenon. The coefficients' unconventional nature does not suggest data manipulation; instead, it signifies a divergence in scientific interpretation. The Investigation Committee's claim of data manipulation lacks foundation and suggests a misunderstanding or alternative agenda. A figure is presented below illustrating a linear temperature-dependent resistance subtraction applied to three curves, emphasizing that the fundamental observation – the shift in Tc with an applied magnetic field – remains unchanged, irrespective of the background subtraction method.



e. The Coefficients Were Properly Obtained Using MatLab Software.

The Investigation Committee seemingly acknowledges, albeit reluctantly, that the curves presented in the revised Extended Data Figure 15 are accurately reproduced when calculated correctly. However, the Investigation Committee appears to try to create the impression that certain information was unavailable. This criticism is deceptive, as established high-pressure experimentalists readily recognize fundamental methodologies for identifying pertinent coefficients in the fitting process. In response to this, we offer an elucidation of the fundamental nature of the requested information.

To fit the data to a given data set we used MATLAB's Curve Fitting Toolbox (cftool). MATLAB, a powerful numerical computing environment. This toolbox simplifies the complex process of fitting mathematical models to experimental data, enabling us to extract meaningful insights and patterns.

The Curve Fitting Toolbox is designed to streamline the curve fitting process, providing a user-friendly interface. It offers a range of curve fitting techniques, from basic linear fits to complex nonlinear models. The key advantage of cftool lies in its ability to interactively explore data, test various models, and optimize parameters in real-time.

In the process of utilizing cftool for fitting a dataset based on a known formula, it is essential to follow a systematic approach. To begin, import the dataset into the Curve Fitting Tool from your MATLAB workspace. Typically, the dataset comprises two vectors, one representing the independent variable (e.g., x), and the other the dependent variable (e.g., y).

Next, select a fitting model that aligns with the known formula you intend to employ. If the available options do not match your formula, the tool allows you to specify a custom model. Subsequently, the tool endeavors to fit the data using the chosen model. During this stage, you can observe the initial fit and make necessary adjustments to parameters.

For a refined fit, you have the flexibility to modify fitting options, including starting points for parameters, algorithm settings, and constraints on parameters. Once you achieve a satisfactory fit, export the results back to the MATLAB workspace for further analysis or utilize the generated coefficients in subsequent calculations.

Moreover, cftool offers the functionality to generate MATLAB code corresponding to your fitting process. This feature is beneficial for documentation purposes or for applying the same process to new datasets.

It is crucial to emphasize that effective curve fitting extends beyond tool usage. A comprehensive understanding of the underlying physics or mathematics of the data is paramount. The selection of an appropriate model and the interpretation of results within the context of the specific application are integral aspects of ensuring meaningful and accurate curve fitting outcomes.

The adoption of MATLAB's cftool for coefficient acquisition in the curve fitting process stands as a recognized and effective methodology. It is important to emphasize that employing this approach is standard practice, devoid of any irregularities or deviations. Contrary to the unfounded insinuations made by the Investigation Committee, this approach does not align with data manipulation or fabrication. Such assertions are baseless and do not accurately reflect the legitimate and commonplace use of cftool for scientific data analysis.

f. Conclusion in Response to Accusation No. 3.

In addressing the Investigation Committee's concerns regarding our research, particularly the focus on the R(T) data in Extended Data Figure 15 (EDF 15), I aim to offer a detailed clarification. It's crucial to emphasize that EDF 15 played no role in the main findings of our Nature 2023 paper, and none of its data, parameters, or conclusions were referenced in the main body of the paper. Despite the Investigation Committee's implication of data falsification, there was no intention to mislead editors or peer reviewers during the pre-publication peer review process.

Regarding the Investigation Committee's claim about incorrect tick labels on the vertical axis plot of voltage data, it's important to highlight a fundamental misunderstanding on their part. The voltage values were measured in millivolts, not volts, aligning with the representation on the plot. The Investigation Committee's assertion fails to acknowledge this crucial detail, and any suggestion of wrongdoing is unfounded.

I'd like to emphasize the availability of EDF 15_RvsT_Magnetic Field Studies.csv during the pre-publication peer review process, which is supported by email communications with the pre-publication editors. The main referee, a distinguished expert in superconductivity, actively contributed valuable insights that significantly enhanced the manuscript. The Investigation Committee's premature conclusion about the data's unavailability is debunked through these documented interactions.

Moving on to the section on background subtraction, it's important to underscore its standard practice in high-pressure superconductivity studies. Multiple examples from other research papers, such as Zomayazulu et al., Osmond et al., and Kong et al., illustrate the necessity of background subtraction for accurate data interpretation. I challenge the Investigation Committee's unsupported allegations, suggesting that accepting their claims would implicate numerous high-pressure papers in the field.

Let's discuss the fit coefficients, delving into the choice of a residual resistance equation and its unconventional coefficients. I'd like to highlight the insignificantly small T^5 coefficient, emphasizing its negligible impact. The Investigation Committee's claim of data manipulation is debunked, attributing the unconventional coefficients to a divergence in scientific interpretation.

Lastly, addressing the Investigation Committee's criticism of MATLAB usage for obtaining fit coefficients, I want to elaborate on the systematic approach using MATLAB's Curve Fitting Toolbox. It's essential to emphasize that the use of cftool is a recognized and effective methodology, contrary to the Investigation Committee's uninformed insinuations of irregularities.

In summary, my response provides a comprehensive and accurate account, refuting the Investigation Committee's conclusions as lacking credibility, misinterpreting data, and potentially influenced by bias. I reiterate our commitment to transparency, scientific integrity, and adherence to standard scientific practices throughout the research and peer-review process.

* * *

4. Figure 4, C(T) Data (Specific Heat Capacity as a Function of Temperature) Was Not Fabricated nor Falsified.

My response herein collectively addresses all four claims wrongly made by the Investigation Committee as all the claims relate to the same issue i.e. the incorrect assertion that I used an inverted signal to misrepresent a signal that is expected to look like a superconducting transition.

a. The Published Data for the Heat Capacity (C(T)) Curve at 20kbar Was Not Manipulated.

b. The Published Data for Heat Capacity versus Temperature Series Was Not Manipulated.

c. The Raw Specific Heat Capacity Data Was Not Manipulated.

d. The Inverse of the Specific Heat (i.e. Voltage) Was Not Incorrectly Reported.

Firstly, the Investigation Committee's claim that I used an inverted signal to misrepresent a superconducting transition overlooks essential phase corrections, constituting a fundamental flaw in their analysis.

Secondly, their evaluation of heat capacity behavior in superconductors lacks accuracy. Describing the superconducting transition as exhibiting a "positive jump" oversimplifies the complexities of this second-order phase transition. It is generally understood that a superconducting material undergoing such a transition typically displays a distinct peak or jump at the critical temperature (Tc), indicating a change in specific heat capacity. Any deviation from this understanding reveals a significant gap in knowledge of basic superconducting experimental results.

Distinguishing the heat capacity signal in a superconducting transition from a structural phase transition requires careful analysis. While both transitions may manifest characteristic changes in heat capacity, a first-order structural transition may show a latent heat (discontinuity) at the transition temperature, and a second-order transition might present a more gradual change or a peak like a superconducting transition, albeit broader and accompanied by other property changes. To eliminate ambiguity, X-ray diffraction studies at low temperatures for the Lu-H-N sample have ruled out the possibility of a structural phase transition.

In the realm of high-pressure heat capacity studies, a notable contribution was made by Tateiwa et. al. in 2003, focusing on UGe2—a material displaying both superconductivity and ferromagnetism. Subsequently, the methodology employed in our investigation traces back to my

tenure as a graduate student at WSU, where it was initially utilized to explore superconductivity in CS2 (carbon disulfide). Although our attempts yielded no reliable signal due to the exceptionally high-pressure requirements (50 GPa), the method proved successful in the examination of MgB2. This adaptation was drawn from Umehara et al.'s paper, 'Heat Capacity Measurements under High Pressure.

Several years later, while at the University of Rochester, I directed students within my group to implement the method precisely as I had employed it. Their successful execution, however, occurred without a comprehensive grasp of the underlying data.

In the realm of calculating specific heat capacity through AC calorimetry, a meticulous analysis involving the voltage signal, temperature, and frequency of the applied heat is typically required. AC calorimetry entails the application of an oscillating heat signal to a sample, with subsequent measurement of the resulting temperature oscillations. Deriving specific heat capacity involves a careful consideration of the amplitude and phase shift of these temperature oscillations relative to the applied heat. The aforementioned information outlines the historical context and methodology, underscoring the Committee's oversight in fully understanding the intricacies of the data involved.

The real part of the signal derived from the lock-in amplifier signifies the in-phase component relative to the reference signal. In the context of A.C. calorimetry, the real part typically denotes the dissipative component of the system, directly linked to the heat capacity of the sample. As the sample absorbs energy from the A.C. heating, it induces a temperature oscillation in phase with the heating power, a phenomenon precisely measured by the real part. In the realm of heat capacity measurements, the real part serves as the primary data of interest, offering insights into how the sample's temperature responds to the applied oscillatory heating.

Conversely, the imaginary part corresponds to the out-of-phase component. In certain calorimetry setups, particularly those featuring a non-purely resistive thermal response (i.e., possessing a reactive component), the imaginary part can provide valuable information about thermal lag or the time delay between the heating power and the sample's response. This insight can be indicative of issues such as insufficient thermal coupling. While the imaginary part is often employed to correct or comprehend the thermal inertia of the system, it typically does not serve as the primary data source for heat capacity measurements.

As highlighted in a prior section, the necessity for phase correction in our measurements is paramount. In applications demanding precision, such as lock-in amplification, where accurate phase and magnitude information play a crucial role, it becomes imperative to address frequency-dependent phase shifts and magnitude changes introduced by preamplifiers. Our experimental setup employed the SRS 554 pre-amplifier, known for inducing a phase shift and altering the magnitude of the input signal. This alteration can distort the accurate phase information originating from the sample under investigation, emphasizing the need for compensatory adjustments to ensure precise phase measurements that significantly impact the true signal value during a transition.

To facilitate a better understanding, the SRS 554 pre-amp manual provides additional insights into the specificities of our pre-amplifier. The adjustment process typically involves fine-tuning the

phase until the real part of the lock-in amplifier's output accurately represents the in-phase component of the signal. This meticulous phase adjustment ensures the correct alignment of the phase relationship between the measured signal and the reference signal, proving indispensable in extracting the signal of interest, especially in environments characterized by high noise or interference. Consequently, accurate phase alignment emerges as a critical factor for correct measurements in numerous scientific and engineering applications, including AC measurements such as heat capacity, magnetic susceptibility, and resistivity, constituting a standard scientific practice.

In the context of a superconducting transition, the heat capacity signal theoretically displays a jump, and any deviation from this anticipated behavior could be attributed to factors like stray reactance, which varies with temperature, noise, or shifts induced by the use of the SRS 554 pre-amplifier.

In summary, while the possibility of phase adjustment exists in certain cases, it should be executed with meticulous care and a thorough understanding of the measurement setup and circuit characteristics. Rigorous attention to proper calibration, equipment settings, and signal processing techniques becomes crucial for minimizing phase errors and enhancing the overall accuracy of measurements. During the data analysis process for the Lu-H-N system, initial manual phase adjustments were conducted; however, we have since developed a Python program to streamline and enhance the visualization, examination, and saving of phase-adjusted data. The attached program facilitates any necessary phase adjustment tests. See Appendix IV hereto.

In summary, it is standard practice to perform phase adjustments for all three crucial measurements for: 1) magnetic susceptibility; 2) electrical resistance; and 3) heat capacity. To offer a comprehensive perspective, I would like to illustrate instances of phase correction applied to magnetic susceptibility data, particularly in the analysis of Lu-H-N magnetic data. This meticulous analysis was carried out by graduate students Nathan Dasenbrock-Gammon and Sachith Dissanayake. It is concerning that the Investigation Committee and the leadership at the University of Rochester appear to have overlooked the work conducted by Nathan Dasenbrock-Gammon and Sachith Dissanayake. This oversight suggests a potential bias, as an accurate assessment of their work would necessitate considering all other phase corrections as valid. The failure to explore these critical data points raises questions about whether there was an intentional omission, possibly to obscure the validity of the phase correction method employed in my analyses.

In the context of A.C. magnetic susceptibility signals, the real part corresponds to the inductive response (energy storage), while the imaginary part corresponds to loss (energy dissipation) in the sample. Figure 1 illustrates an example of this relationship. Typically, in magnetic susceptibility measurements, the real part exhibits a negative drop in the signal due to the superconducting transition, while the imaginary part often displays a positive peak corresponding to energy dissipation. However, as previously explained, phase shifts can alter this expected behavior, necessitating phase adjustments for accurate interpretation. Let's consider an illustrative example with MgB2, a well-known superconductor with a critical temperature (Tc) of 39 K.

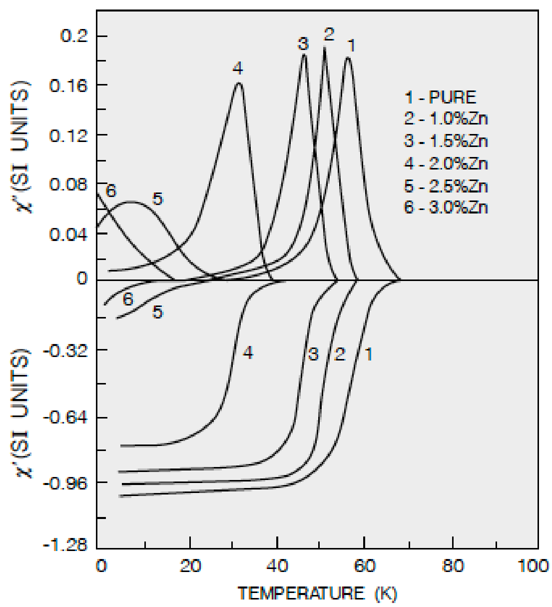


Figure 1. Real and imaginary part of superconducting LaBaCa(Cu1-xZnx)O7- δ

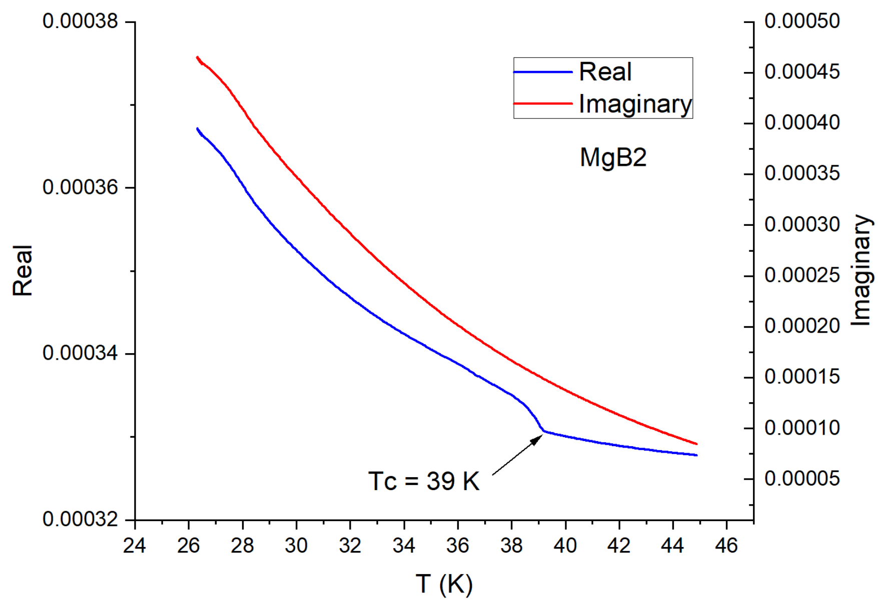


Figure 2. Real and imaginary part of superconducting MgB2. If you take this data as it is then MgB2 undergoes a ferromagnetic transition at 39 K, which is not the case.

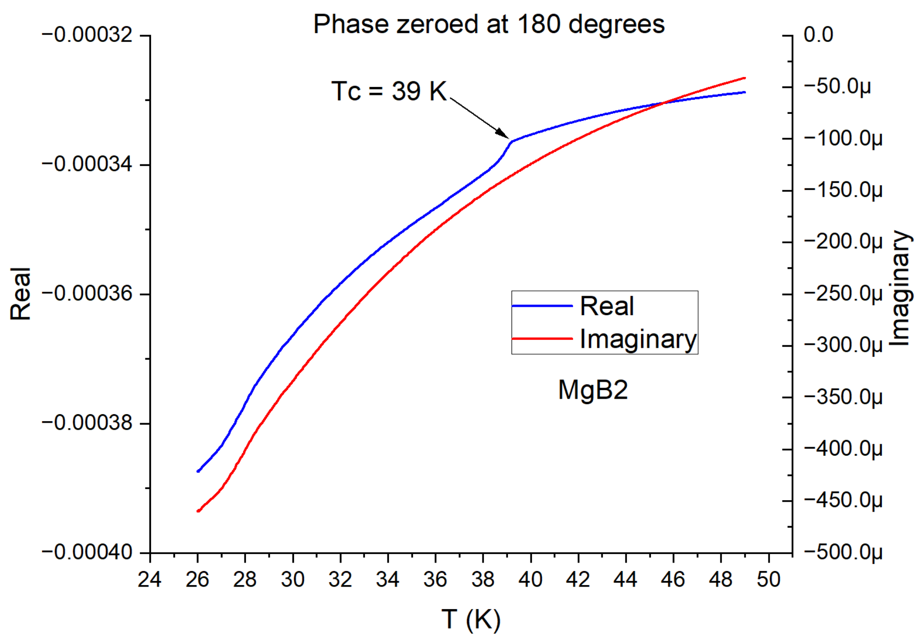


Figure 3. Phase adjusted real and imaginary part of superconducting MgB2.

Figure 2 depicts the raw data obtained from a signal frequency magnetic susceptibility measurement. Notably, in this instance, the real part of the data is inverted, deviating from the anticipated drop, and the imaginary part appears fully dissipated. To faithfully represent the authentic behavior of the sample, a necessary step involves implementing a phase adjustment. As illustrated in Figure 3, which showcases the phase-adjusted data zeroed at 180, both the real and imaginary parts correctly exhibit the expected drop in the real part—an indicative response in such measurements.

Here is another example: ErBa2Cu3O7 with Tc ~93.5K.

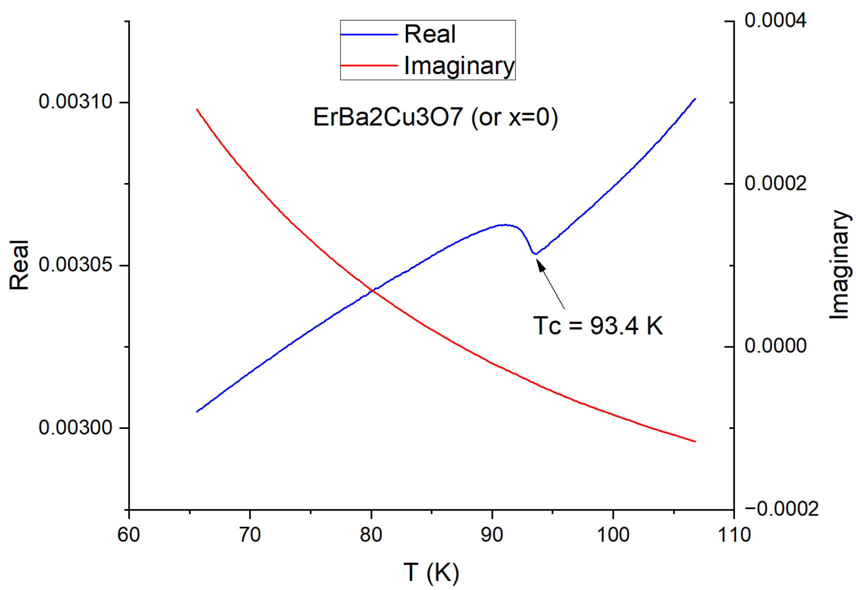


Figure 4. The real and imaginary part of superconducting cuprate. The signal is inverted.

The real part of the signal in the ErBa2Cu3O7, akin to the MgB2 sample, is inverted. Contrary to the anticipated drop, there is an observed upward jump, and the imaginary part appears to be fully dissipated. To faithfully represent the data, a requisite phase adjustment is necessary.
Another illustrative example involving MgB2 is presented in Figure 5.

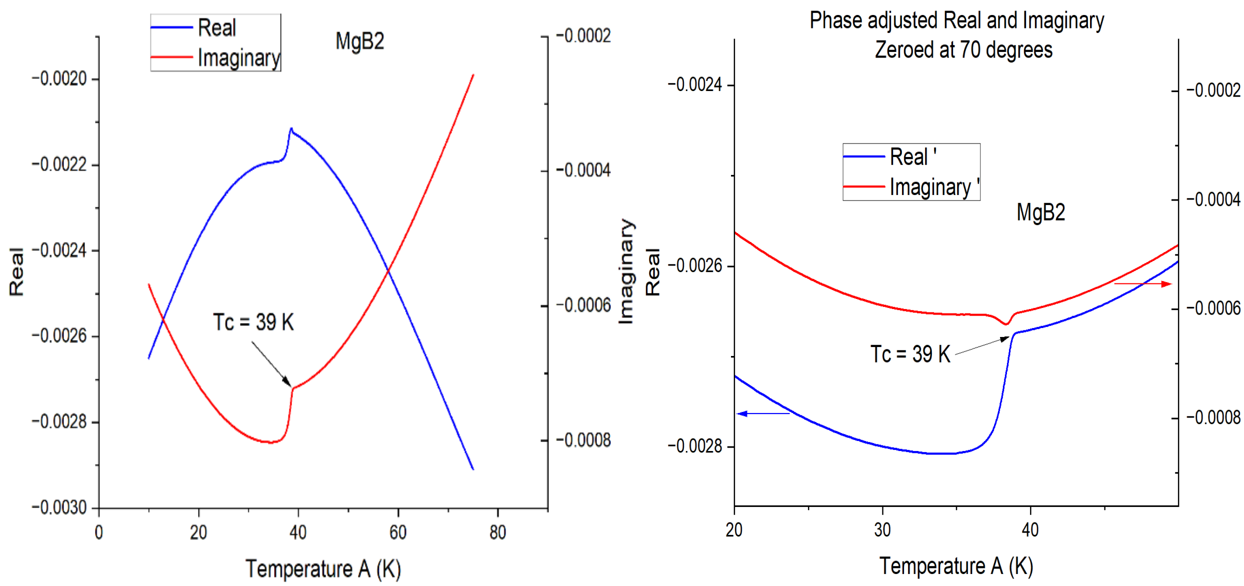


Figure 5. The left figure is the raw data and the right figure is, phase adjusted real and imaginary part.

As illustrated in Figure 5, an anomaly is observed where the real and imaginary parts appear to be interchanged, with the majority of the signal from the real part now present in the imaginary part. In such a scenario, the absence of full dissipation in the imaginary part would usually result in an anticipated peak. The right side of the figure showcases the phase-adjusted real and imaginary parts, offering a more precise representation of the data.

Several techniques are employed for measuring A.C. susceptibility in superconductors, and the aforementioned examples are rooted in the single-frequency method. Another prevalent approach in high-pressure experiments is the double-frequency modulation technique. In this method, the magnitude of the signal is utilized, typically presenting as an asymmetric positive peak. Figure 6 provides an illustration of a standard signal obtained through the double-frequency method on a MgB2 sample. The anticipated response signal should theoretically manifest as a positive peak, as observed in Figure 6.

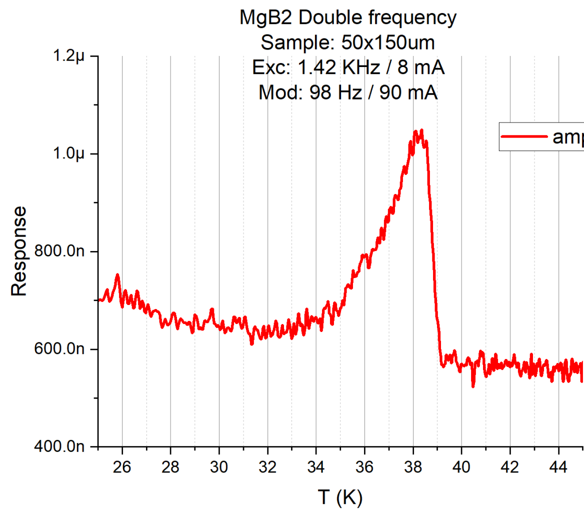


Figure 6. The double frequency response of the superconducting MgB2.

Contrary to theoretical expectations of a positive peak, experimental results have consistently shown an inverted peak in numerous instances. An illustrative example is presented in Figure 7.

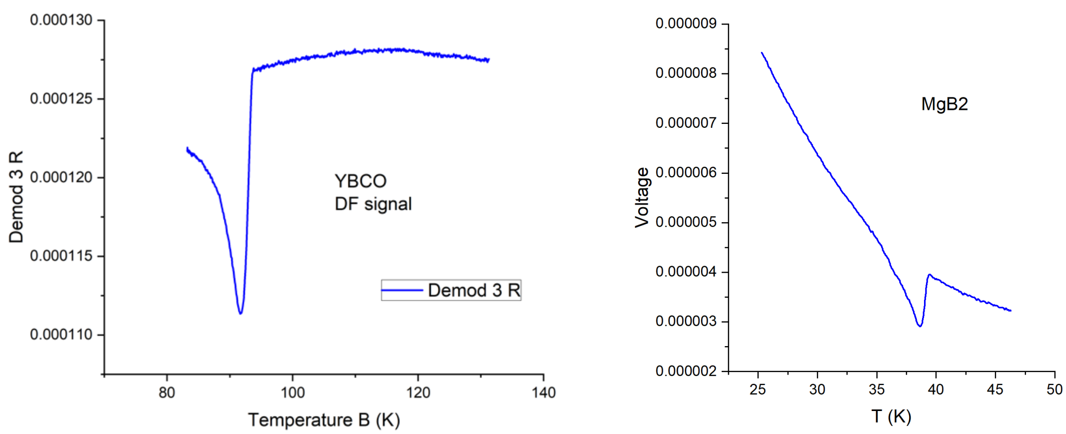


Figure 7. Two different superconducting materials showing an inverted signal. The left figure is an example of inverted response from YBCO cuprate and the right figure is an example of inverted response from MgB2 sample.

In summary, while the conventional expectation in AC susceptibility measurements is to observe either a positive peak (double frequency method) or a drop in the signal (single frequency), this is not universally applicable. External perturbations stemming from the experimental apparatus can influence measurements, warranting the implementation of a phase correction. It is crucial to emphasize that such phase corrections are standard procedures in scientific research. Often, they may not be explicitly detailed in the results section as they are deemed standard practice in data analysis, widely employed by scientists in the field.

Now, let's delve into the resistance studies using MgB2, a widely recognized and standard superconductor for these measurements. Figure 8 below depicts the resistance studies as a function

of temperature on a superconducting MgB2 sample, featuring three curves: Magnitude, real, and imaginary parts of the signal.

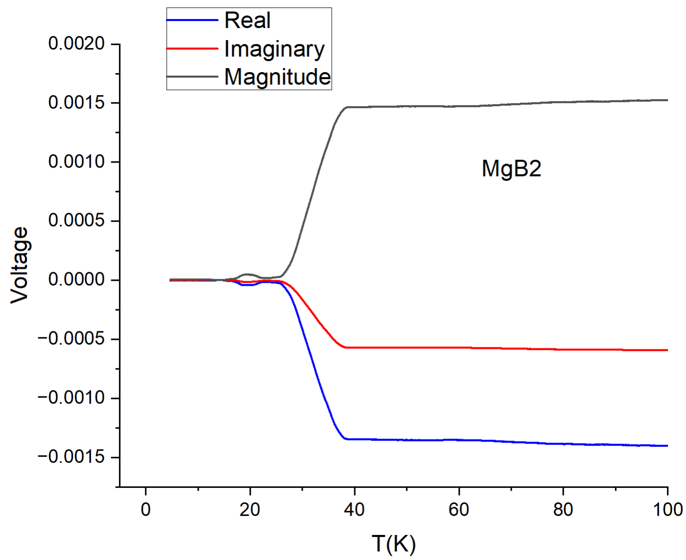
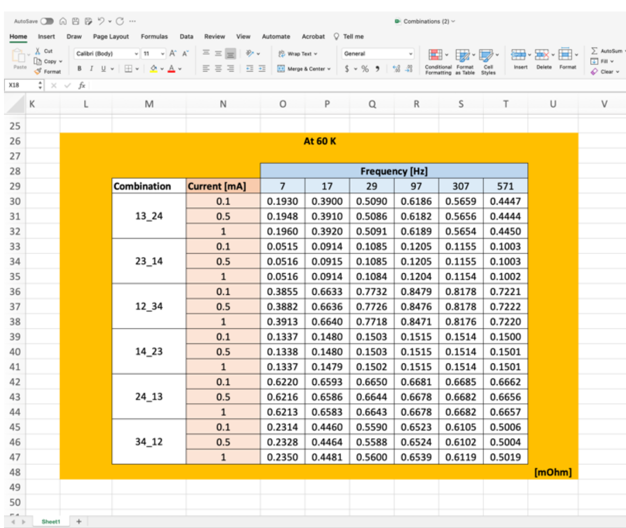


Figure 8. The resistance measurements of the superconducting

As observed in the displayed plot, there is a notable presence of stray inductance, particularly evident in the significant contribution to the imaginary part. The table below provides a comprehensive overview of our studies on frequency-dependent resistance and current-dependent resistance. These studies reveal an increase in resistance with frequency, pointing towards the influence of stray inductance.



At 60 K

Combination	Current [mA]	Frequency [Hz] 7	17	29	97	307	571
13_24	0.1	0.1930	0.3900	0.5090	0.6186	0.5659	0.4447
	0.5	0.1948	0.3910	0.5086	0.6182	0.5656	0.4444
	1	0.1960	0.3920	0.5091	0.6189	0.5654	0.4450
23_14	0.1	0.0515	0.0914	0.1085	0.1205	0.1155	0.1003
	0.5	0.0516	0.0915	0.1085	0.1205	0.1155	0.1003
	1	0.0516	0.0914	0.1084	0.1204	0.1154	0.1002
12_34	0.1	0.3855	0.6633	0.7732	0.8479	0.8178	0.7221
	0.5	0.3882	0.6636	0.7726	0.8476	0.8178	0.7222
	1	0.3913	0.6640	0.7718	0.8471	0.8176	0.7220
14_23	0.1	0.1337	0.1480	0.1503	0.1515	0.1514	0.1500
	0.5	0.1338	0.1480	0.1503	0.1515	0.1514	0.1501
	1	0.1337	0.1479	0.1502	0.1515	0.1514	0.1501
24_13	0.1	0.6220	0.6593	0.6650	0.6681	0.6685	0.6662
	0.5	0.6216	0.6586	0.6644	0.6678	0.6682	0.6656
	1	0.6213	0.6583	0.6643	0.6678	0.6682	0.6657
34_12	0.1	0.2314	0.4460	0.5590	0.6523	0.6105	0.5006
	0.5	0.2328	0.4464	0.5588	0.6524	0.6102	0.5004
	1	0.2350	0.4481	0.5600	0.6539	0.6119	0.5019

[mOhm]

Figure 9. The frequency dependent resistance measurements of the superconducting MgB2 at 60 K.

In the background section of the response to Figure 2a in the Nature paper, it has been elucidated that reporting the magnitude as resistance is inaccurate in this context. Instead, the phase-corrected real part offers a more precise reflection of the actual change in the resistance of the sample. To provide a clearer insight, I propose presenting a zoomed-in version of the data during the superconducting state. Figure 10 below illustrates the real, imaginary, and magnitude components of the signal in the superconducting state. Notably, zero resistance is not observed. As previously

explained, achieving zero resistance in high-pressure experiments is challenging due to residual contributions from stray inductance and offsets. To faithfully represent the material's true behavior, we have executed a phase correction to account for stray inductance. However, a minor residual resistance, approximately around 4 micro Ohms, persists due to instrument offset, as depicted in Figure 11.

This approach is indispensable for accurately interpreting data from high-pressure experiments, where attaining idealized conditions such as perfect zero resistance is often unfeasible due to inherent experimental limitations. In my perspective, the most effective way to analyze resistance phase adjustment is by dividing the process into two sections: (i) before the transition, and (ii) after the transition.

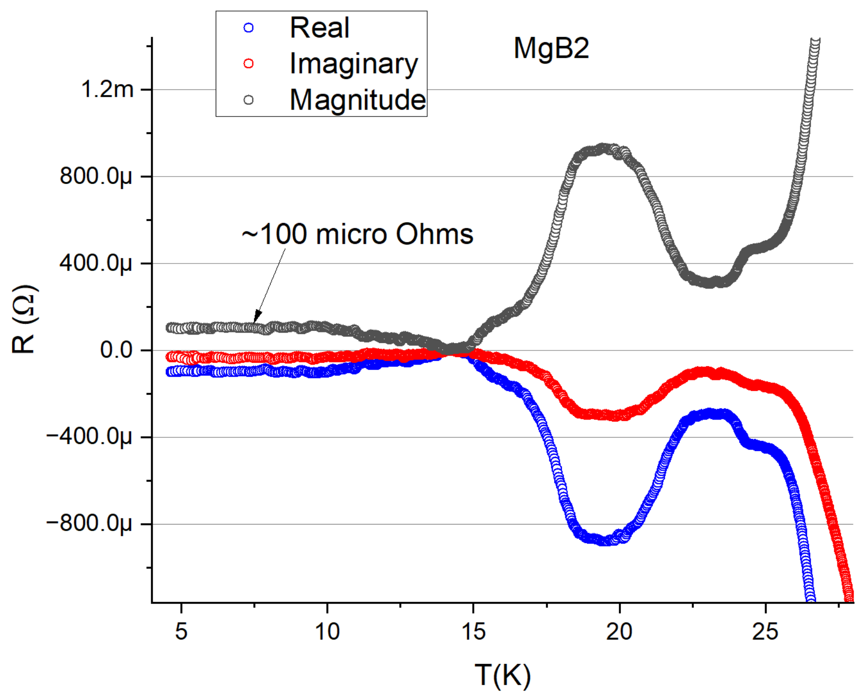


Figure 10. The real, imaginary, and magnitude components of the signal, depicted in blue, red, and black colors, respectively during the superconducting state. The magnitude component indicates a residual resistance of approximately 100 micro Ohms, contrary to the expected zero resistance for this superconducting sample. However, a detailed analysis of the frequency-dependent resistance studies suggests the presence of stray inductance in the setup. Additionally, at around 18 K, there is an observable upturn in resistance, a feature like that seen in the Lu-H-N data at 10 kbar. This pattern suggests that such behavior is common in these types of measurements. To represent the data accurately and effectively, phase correction is necessary.

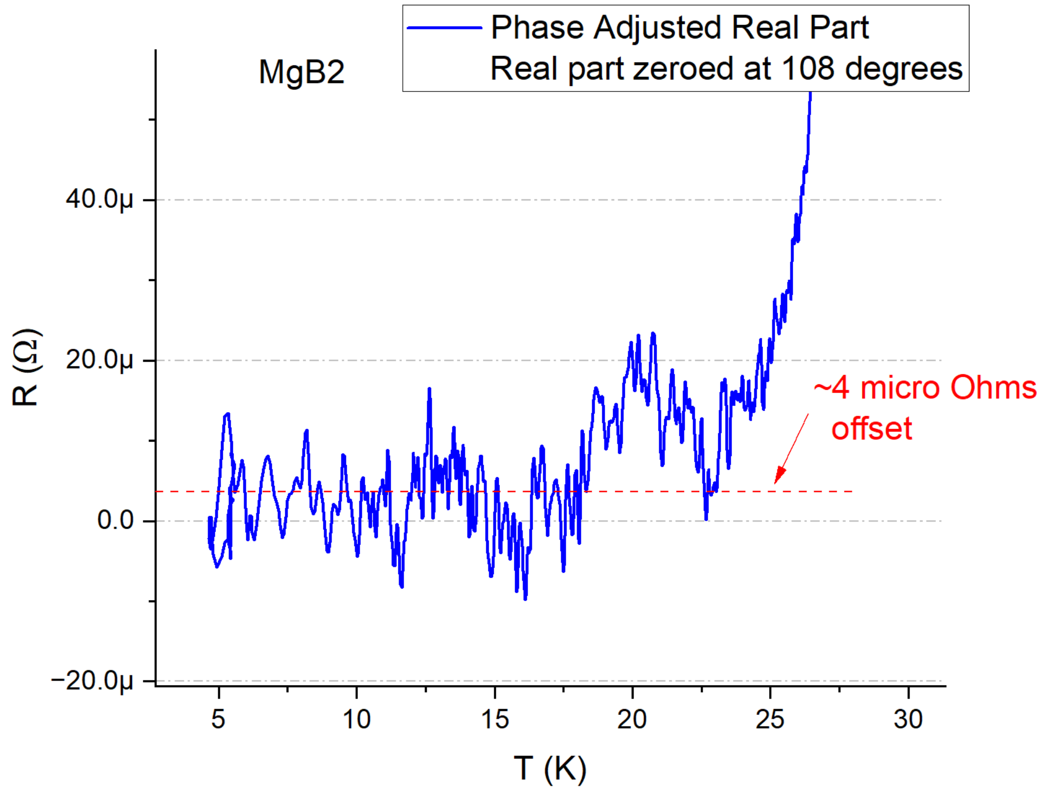


Figure 11. The phase corrected resistance data of the superconducting state of the MgB2 sample. The red dash line indicates the offset value from the instruments.

As demonstrated through the two examples above, the need for phase correction is not exclusive to specific types of measurements, and heat capacity measurements are no exception. Let's delve into the Investigation Committee's accusations and the associated data.

Firstly, I would like to address the Investigation Committee's assertion that the "data were derived from the sequestered data," which is not only misleading but fundamentally incorrect. The suggestion of a derivation process is baseless, unless the reference is to standard data analysis procedures. In the scientific context, all analyzed data presented in research papers undergo a derivation process from raw data. To insinuate that analyzed data imply manipulation is a misleading characterization. It is evident to me that the Investigation Committee is intentionally framing my work negatively by using the term 'derived,' which carries unwarranted implications of data fabrication. Such an accusation lacks merit and represents a deliberate distortion of the facts, aiming to exaggerate and misrepresent the reality of the situation.

In our examination of heat capacity data, we have benchmarked our methodology against well-established materials, with Magnesium Diboride (MgB_2) serving as a common superconductor for calibration purposes. According to existing literature, the heat capacity response is typically inversely proportional to the AC output voltage measured by the Lock-in amplifier.

The correlation between heat capacity response and AC output voltage, as detailed in the referenced paper below, is elucidated through the highlighted equation employed. However, Umehara et al. also acknowledge that "[t]his approximation is reasonably accurate, as the temperature variation of the thermocouple's thermopower remains relatively constant within our measurement temperature range." This acknowledgment suggests that while there is a general understanding of the signal's trend, uncertainties persist regarding its precise behavior at higher temperatures.

Moreover, even when the signal direction is known, the intricate interplay of phase changes induced by various components in the experimental setup remains a complex issue. This complexity underscores the necessity for meticulous consideration and calibration in heat capacity measurements, especially when interpreting signal direction and comprehending how diverse factors in the setup may impact the measurement.

Novel Pressure-induced Phenomena in Condensed Matter Systems
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Heat Capacity Measurements under High Pressure

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$$C = -P sin\Delta\phi / \omega |T_{ac}| \quad (2)$$

Where P, $\Delta\phi$ and ω are the applied heating power, phase shift and frequency of measurement, respectively. If ω is suitable for the experimental condition, the heat capacity C or $|T_{ac}|^{-1}$ is inverse proportion to observed Lock-in-voltages V. This would be approximately true, as the temperature variation of thermocouple's thermopower is more or less constant in our measurement temperature range.

Figure 12 below presents the raw data recorded during the heat capacity measurement of MgB2. It is evident that the data is inverted when applying the same understanding as seen in other studies in the literature.

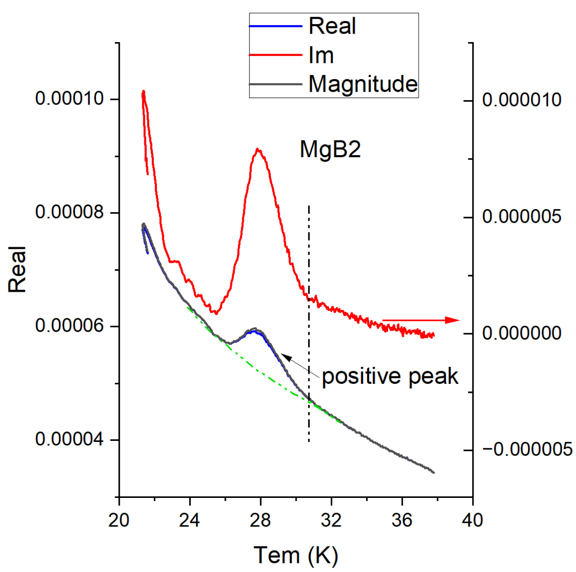

Figure 12. The temperature dependent voltage response directly from the recorded data of the superconducting MgB2 sample. The real and the magnitude are almost identical, and the imaginary part represent a more distinct peak starting from ~ 30K. All three components show a positive peak.

As indicated in the literature, the heat capacity response is commonly inversely proportional to the AC output voltage measured by the Lock-in amplifier. In the case of the provided data on MgB2, taking the inverse of the observed voltage reveals a dip in the response rather than the expected

positive peak indicative of a superconducting transition. This deviation from the theoretical jump in the heat capacity signal during a superconducting transition raises questions, and potential causes such as stray reactance, which can vary with temperature, noise, or shifts due to the use of the SRS 554 pre-amp, need consideration.

It is crucial to reiterate that the real part of the signal from the lock-in amplifier reflects the dissipative component of the system in A.C. calorimetry, directly associated with the heat capacity of the sample. The real part's measurement captures the temperature oscillation in phase with the heating power when the sample absorbs energy from A.C. heating. This real part often serves as the primary data of interest for heat capacity measurements, offering insights into how the sample's temperature responds to applied oscillatory heating.

Conversely, the imaginary part corresponds to the out-of-phase component and, in certain calorimetry setups, particularly those with reactive components, may contain valuable information about thermal lag or time delay between the heating power and the sample's response. While the imaginary part is utilized to correct or comprehend the thermal inertia of the system, it generally does not serve as the primary source of data for heat capacity measurements. Consequently, phase correction is imperative in these measurements to ensure an accurate representation of the data, as it prevents the misrepresentation of the true signal during a transition.

In summary, while phase adjustment is feasible in certain cases, it necessitates careful execution with a thorough understanding of the measurement setup and circuit characteristics. Proper calibration, appropriate equipment settings, and effective signal processing techniques are indispensable for minimizing phase errors and enhancing measurement quality. This rationale underscores our use of MgB2 for calibration and refinement of our data analysis process, ensuring accurate phase correction for reliable results. Allow me to present an additional instance of a heat capacity measurement involving MgB2, wherein the signal exhibits an inversion.

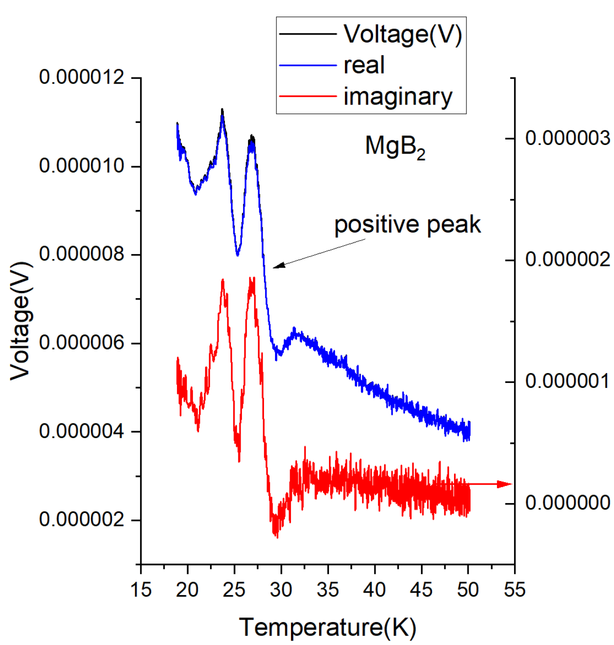

Figure 13. The temperature dependent voltage response directly from the recorded data of the superconducting MgB2 sample. The real and the magnitude are almost identical. All three components show a positive peak. If we take the inverse of the observed voltage, we will observe a dip in the response rather than a positive peak. This dip is not the expected signature of a superconducting transition. In a superconducting transition heat capacity signal should theoretically show a positive jump. Note that multiple jumps are due to sample in different pressure with different Tc.

Considering the various examples provided, it becomes evident that the Investigation Committee lacks a comprehensive understanding of the essential role played by phase corrections in the data analysis process. It is crucial to recognize that phase corrections are integral to refining data accuracy, and their omission or misinterpretation can lead to erroneous conclusions. As we navigate through diverse measurement scenarios, the significance of meticulous phase adjustments remains a critical component in ensuring the reliability and validity of scientific findings. The examples underscore the importance of acknowledging and addressing the complexities inherent in experimental setups, ultimately contributing to a more nuanced and accurate understanding of the observed phenomena. The below figure shows the steps of phase correction on MgB2 data.

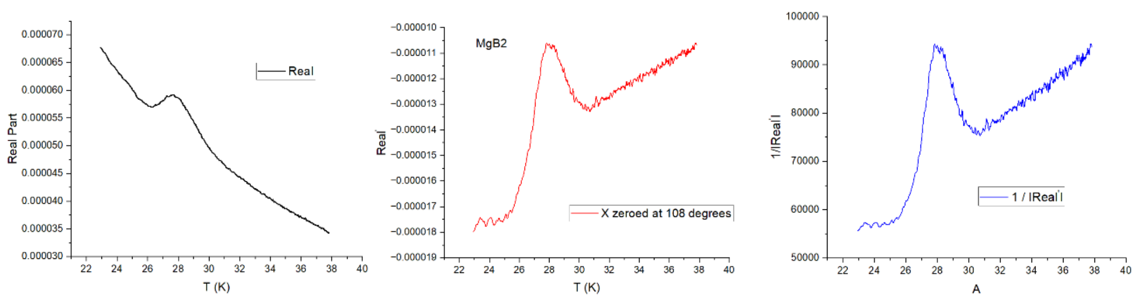

Figure 14. Left. The temperature dependent real part voltage response directly from the recorded data of the superconducting MgB2 sample. Middle: The phase adjusted real part represent a more distinct peak starting from ~ 30K. Right: Specific heat proportional to 1/phase corrected voltage.

Furthermore, the instances presented, whether in magnetic susceptibility, resistance studies, or heat capacity measurements, highlight the intricacies involved in interpreting signals accurately. The need for phase adjustments is not a sign of manipulation but rather a standard scientific practice essential for addressing complexities arising from experimental setups, stray inductance, and other contributing factors.

e. Conclusion in Response to Accusation No. 4.

In conclusion, my comprehensive response has effectively refuted the four claims made by the Investigation Committee, particularly in the context of heat capacity measurements and the alleged use of an inverted signal to misrepresent a superconducting transition. Throughout the examination, I highlighted the intricacies of superconducting transitions and the crucial role of phase corrections in interpreting the data.

Additionally, I incorporated new information into the conclusion, placing emphasis on benchmarking the methodology against well-established materials such as Magnesium Diboride (MgB2) for calibration. I explored the correlation between heat capacity response and AC output voltage, revealing uncertainties in the signal's behavior at higher temperatures. The complexity arising from phase changes induced by various components in the experimental setup was underscored, highlighting the necessity for meticulous consideration and calibration in heat capacity measurements.

The inclusion of raw data from the heat capacity measurement of MgB2 further supports my argument, showcasing the inversion of data observed in other studies in the literature. The deviation from the expected positive peak raises questions about potential causes, including stray reactance and shifts induced by the pre-amplifier.

I delved into the discussion on the real and imaginary parts of the signal from the lock-in amplifier, providing a clear understanding of their roles in A.C. calorimetry and emphasizing the importance of phase correction. The examples I presented across different measurements reaffirm the standard scientific practice of phase adjustments for accurate data representation.

Overall, my comprehensive analysis underscores the Investigation Committee's lack of a comprehensive understanding of the role played by phase corrections in data analysis. It emphasizes the significance of acknowledging and addressing complexities in experimental setups for a nuanced and accurate interpretation of observed phenomena. The provided examples across diverse measurement scenarios further strengthen the argument for the standard scientific practice of phase adjustments, ensuring the reliability and validity of scientific findings.

* * *

5. Figure 3a, M(T) Data (Magnetic Moment as a Function of Temperature) Was Not Fabricated nor Falsified.

My response herein collectively addresses all four claims wrongly made by the Investigation Committee as all the claims relate to the same issue i.e. the incorrect assertion that the actual superconducting signal is coming from the 32-millimeter distance when in fact that is the actual background signal coming from different phases and external factors.

a. The Raw Magnetization Data Was Not Incorrectly Reported.

b. The ZFC and FC Curves Were Not Incorrectly Reported.

c. The ZFC and FC Curves Were Not Fabricated.

d. The Published FC Data Were Not “Derived” from the Sequestered Data and the assertion is misleading.

While examining the significance and evaluating the evidence supporting superconductivity in our PPMS data, it is imperative to shed light on the involvement of Dr. Dissanayake, our research scientist, and to address certain discrepancies in his findings. This is important because it appears that the Investigation Committee has placed a great deal of reliance on Dr. Dissanayake.

To gain a comprehensive understanding of the materials under scrutiny, Dr. Dissanayake was enlisted due to his then self-claimed specialized expertise in X-ray diffraction and neutron diffraction. Our primary research goal was to identify the specific phase responsible for inducing superconductivity in the Lu-H-N system.

The synthesized Lu-H-N samples present a challenge due to their pronounced heterogeneity, comprising various phases and subtle variations. When dealing with samples of such pronounced inhomogeneity, the superconducting signal can easily become obscured by signals originating from other phases within the sample. Notable among these phases are LuH_3 (trigonal), LuH_2 (cubic), LuH_{2+} (with numerous variations), LuN, LuN_1-x (exhibiting variations), LuH_2+N_1-x (also showing variations), and Lu_2O_3. The identified stoichiometry for superconductivity is $LuH_{2.2}H_{0.72}$.

Unfortunately, it is crucial to acknowledge errors in Dr. Dissanayake's analyses. Dealing with samples of such heterogeneity, the superconducting signal can be obscured by signals from other phases, and Dr. Dissanayake's findings have encountered discrepancies.

In his X-ray studies, three distinct phases were identified as alpha, beta, and gamma, all exhibiting cubic symmetry. While alpha was confidently identified as LuH_3, the remaining two phases, conforming to the Fm3m structure, remained unknown. Dr. Dissanayake's analysis of the gamma phase, characterized by a lattice parameter of 5.18 Å, led to an intriguing but erroneous breakthrough.

Dr. Dissanayake proposed a cubic phase with a lattice parameter of 5.16 Å as a superhydride (LuH_8) under ambient pressures, presenting it as a significant discovery. He asserted that this marked the first instance of a superhydride manifesting itself under ambient pressures. While I harbored some initial skepticism due to the seeming incredibility of the claim, I opted to embrace his discovery, given his self-professed expertise in X-ray diffraction and neutron diffraction. In his customary fashion, he meticulously prepared a PowerPoint presentation and articulated his argument. He was resolute in his belief that the cubic phase with a lattice parameter of 5.16 Å represents a superhydride, specifically LuH_8, grounded in a volumetric rationale. Please refer to the accompanying figure 1 from his presentation for visual elucidation.

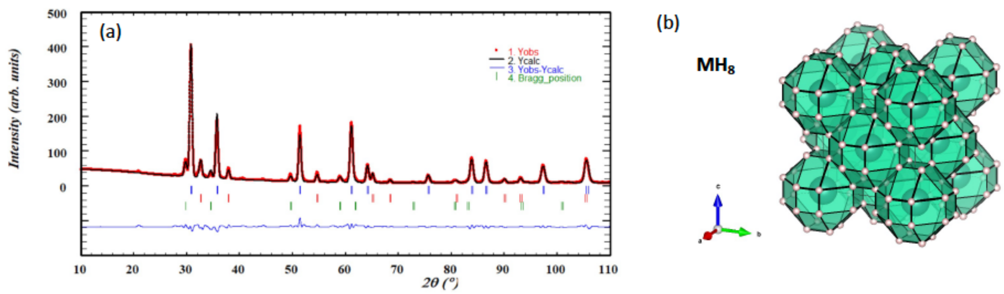

Figure : (a) Rietveld refinement of the x-ray powder diffraction data collected using Rigaku XtaLAB Synergy using micro powder diffraction mode. The red points, black line and blue line represent the observed data, calculated intensity and the difference between observed and calculated intensities. Blue, red and green tick marks represents expected Bragg peak positions for MH_3, high pressure state MH_x and super-hydride MH_8 respectively. (b) Crystal structure of MH_8 with clathrate cage formed by hydrogen atoms.

We called these 3 phases alpha phase, beta phase and gamma phase

Volume/ Red Metal ion = 29.83 Å³

Alpha phase is most likely MH_3, Fm-3m space group, a=5.022 Å. Metal ion is at (0,0,0) (4a).
Therefore, the volume/M ion = 5.022^3/4 = 31.82 Å³
ΔV= 31.82-29.83=1.99 Å³
5.0192287

The following MUEOS fits for lutetium were obtained using ambient pressure volumes V_0(hcp) = 29.833 Å³/atom and $V_0(hR24)$ = 28.341 Å³/atom.

Pressure range 0–93 GPa:

V_0 = 29.833 Å³/atom

B_0 = 52.30 GPa, B_0' = 1.943, and β = 5.685

H	a	c
0	4.892348116	
2		
3	5.019228754	
4	5.004448091	
	5.650798672	
6I	6.058073165	
	4.283704616	
6F	5.019230308	
8F	5.66142476	
8I		

Beta phase can also fit well with Fm-3m space group, a=4.744 Å. Metal ion is at (0,0,0) (4a).
Therefore, the volume/M ion = 4.744^3/4 = 26.82 Å³

Note : Fm-3m and F-43m, has same structure factor for metal ion.
We can also obtain transformation to I4/mmm space group with $a = b = \frac{a_{cubic}}{\sqrt{2}}$ and $c = acubi_c$
*** **ΔV= delta_V=26.82-29.83= -3.01 Å³**

Gamma phase can also fit well with Fm-3m space group, a=5.188 Å. Metal ion is at (0,0,0) (4a).
Therefore, the volume/M ion = 5.188^3/4 = 31.82 Å³
ΔV= delta_V=35.1-29.83= 5.27 Å³
This makes Gamma phase H content according to the volume change = 3/1.99x5.27 = 7.94~= 8

Same note about F-43m and I4/mmm still valid.

Figure 1. Power point slides from Dr. Dissanayake's presentation, which he used to describe his breakthrough discovery.

Our research team dedicated approximately six months to isolating and assessing the superconductivity of the gamma phase. Despite obtaining a substantial portion of the sample, no traces of superconductivity were detected. This raised doubts about the accuracy of the phase loaded into the Diamond Anvil Cell (DAC). Compounding this issue was the inability to conduct X-ray measurements under pressure at the University of Rochester's X-ray facility.

Considering these challenges, a strategic decision was made to shift our focus towards Raman spectroscopy. This technique, proven effective for low Z materials, offered insights into vibrational modes within the sample, including contributions from hydrogen. Despite the complexities involved, our student, Hiranya, successfully obtained spectra for the gamma phase.

Upon reviewing the spectra, distinct features characteristic of an oxide compound were identified. Oxides typically manifest strong and symmetric peaks in their Raman spectra. Leveraging my extensive experience with Raman spectroscopy, the nature of the phase was ascertained, leading to the recommendation for Dr. Dissanayake to scrutinize the gamma phase for confirmation, subsequently identified as Lu_2O_3.

This incident underscores a fundamental lapse in crystallographic judgment, particularly in the verification process of new crystal structures, especially concerning phases like oxides. Such oversights pose significant concerns, particularly in high-pressure studies where discerning results with imperfect data is critical.

Furthermore, ethical concerns arise from Dr. Dissanayake's request for non-disclosure of this matter, especially to Professor Salamat. Given the substantial allocation of resources and time based on the assertion of discovering a new superhydride (LuH_8), confidence in Dr. Dissanayake's rational and analytical thinking has been unequivocally eroded.

This incident highlights the importance of transparency and rigorous scrutiny in our research endeavors. Had I not insisted on obtaining the Raman spectra of the gamma phase, it is conceivable that the erroneous assertion of it being a superhydride might have persisted. Addressing these concerns openly is essential to maintaining the integrity of the investigations.

During the analysis of Raman spectra, a parallel situation unfolded. Dr. Dissanayake confidently stated that the spectrum presented in Figure 2 originated from the LuH3 hexagonal phase—a phase acknowledged for its stability under ambient pressure and commercial availability.

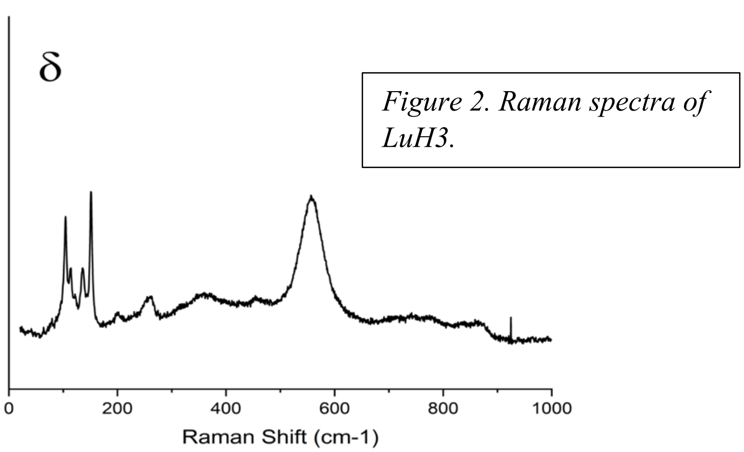

Figure 2. Raman spectra of LuH3.

As is customary, Dr. Dissanayake presented a PowerPoint to support his conclusions. However, I explicitly communicated to him that aligning peak positions in a potential structure with collected data does not inherently validate a structural representation's accuracy. Conversely, I stressed the heightened informativeness of Raman spectroscopy in understanding the unidentified material. Personally conducting factor group analysis I identified 17 phonon modes expected for the trigonal (P3c1) phase, far exceeding the four anticipated for the hexagonal P63/mmc structure. In the Raman spectra, 14 discernible peaks were observed, with meticulous peak fitting providing

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unwavering confidence in all 17 anticipated peaks. Consequently, the hexagonal structure is firmly excluded as plausible.

This marks the second instance of Dr. Dissanayake's fundamental misunderstandings. Disturbingly, he influenced students like Hiranya with flawed conclusions, necessitating my intervention. These incidents, substantiated by concrete evidence, are not isolated; additional comprehension issues surfaced. My discontent extends to his work ethic—arriving late, leaving promptly at 5 PM, and habitually presenting reasons to evade assigned tasks. For instance, when Professor Russell Hemley identified a potential structure exhibiting high Tc superconductivity (possible supercell), I instructed Dr. Dissanayake to examine our data collected at the Advanced Photon Source (APS) under high pressure and low temperatures. He prematurely dismissed the possibility of low-angle peaks corresponding to a supercell, only to acknowledge them upon reevaluation when it was evident that there were indeed three discernible low-angle peaks at 3.8, 4.5, and 5.6 Å. By summer 2023, my dissatisfaction with Dr. Dissanayake led to the decision to explore alternative positions outside my group. This decision was rooted in my lack of confidence in Dr. Dissanayake as well as his inflexibility in scientific discourse, persistently defending his correctness regardless of circumstances.

I would like to address the Investigation Committee's accusations regarding the PPMS VSM data.

While Dr. Dissanayake initially expressed excitement about the PPMS data, he later presented alternative interpretations, consistent with his history of misunderstanding the data. This behavior may reflect a broader confidence issue and a tendency to question results even after validation. It is crucial to acknowledge that scientific interpretation can vary, and differing perspectives are inherent in scientific discourse.

It is important to clarify that the discrepancies in interpretation arose due to the highly inhomogeneous nature of our samples and the challenges associated with obtaining accurate measurements with larger samples, as opposed to the DAC experiments where diamonds were utilized. In the PPMS measurements, which require significantly larger samples, we employed a clamp cell configuration that did not involve diamonds. The use of larger samples introduced a high degree of heterogeneity, characterized by a mixture of numerous phases and subtle variations within individual phases. Commonly observed phases include LuH3 (trigonal), LuH_2 (cubic), LuH_{2+} (with numerous variations), LuN, LuN_{1-x} (exhibiting variations), $LuH_{2+}N_{1-x}$ (also showing variations), and Lu_2O3, necessitating the establishment of the correct background.

During PPMS measurements, requiring significantly larger samples, we adopted a clamp cell configuration devoid of diamonds. The utilization of a larger sample size intensified the degree of heterogeneity, manifesting as a mixture of numerous phases and subtle variations within individual phases. Noteworthy among these phases are LuH3 (trigonal), LuH_2 (cubic), LuH_{2+} (with numerous variations), LuN, LuN_{1-x} (exhibiting variations), $LuH_{2+}N_{1-x}$ (also showing variations), and Lu_2O_3, underscoring the critical need to establish the correct background.

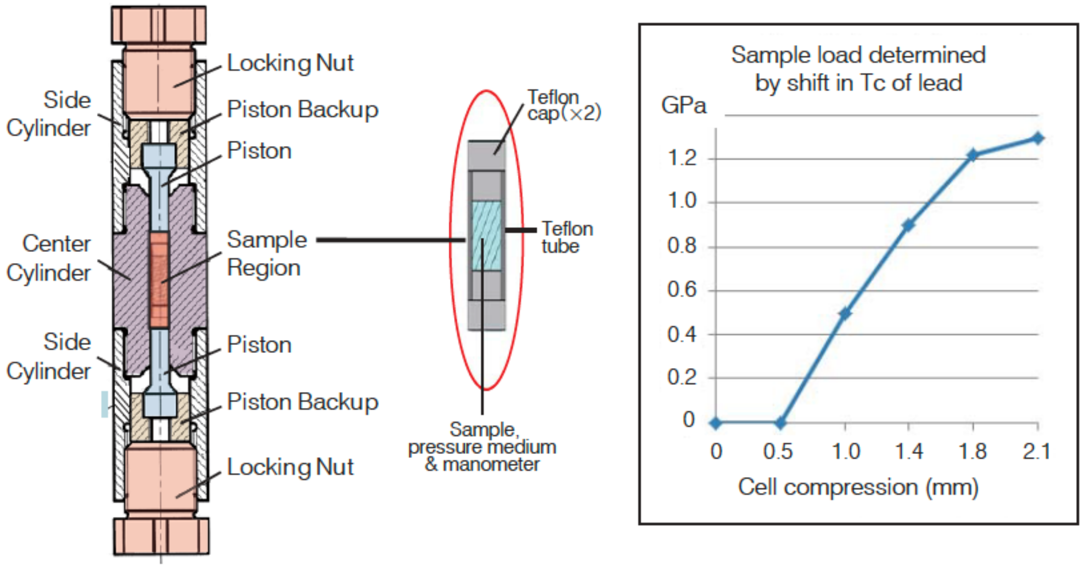

Figure 3: The high-pressure cell employed for VSM measurements. The left side illustrates the schematic of the cell, while the right figure displays the pressure calibration.

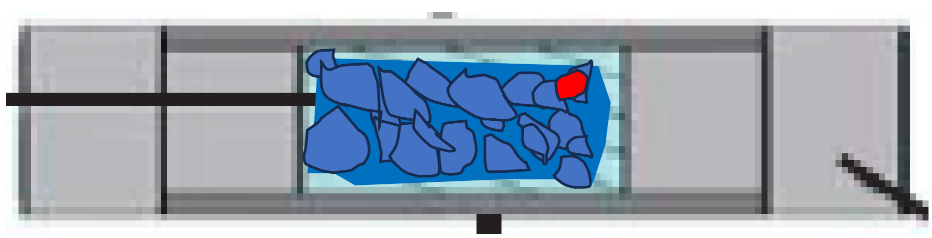

Figure 4: A magnified view of the sample chamber within the pressure cell, along with an illustration of the multiphase sample chamber. The highlighted red piece denotes the superconducting phase.

Examining the data, the following figure presents the complete MH curve at 10 K, with the identified position of the superconducting (SC) phase within the sample at a distance of 30 mm.

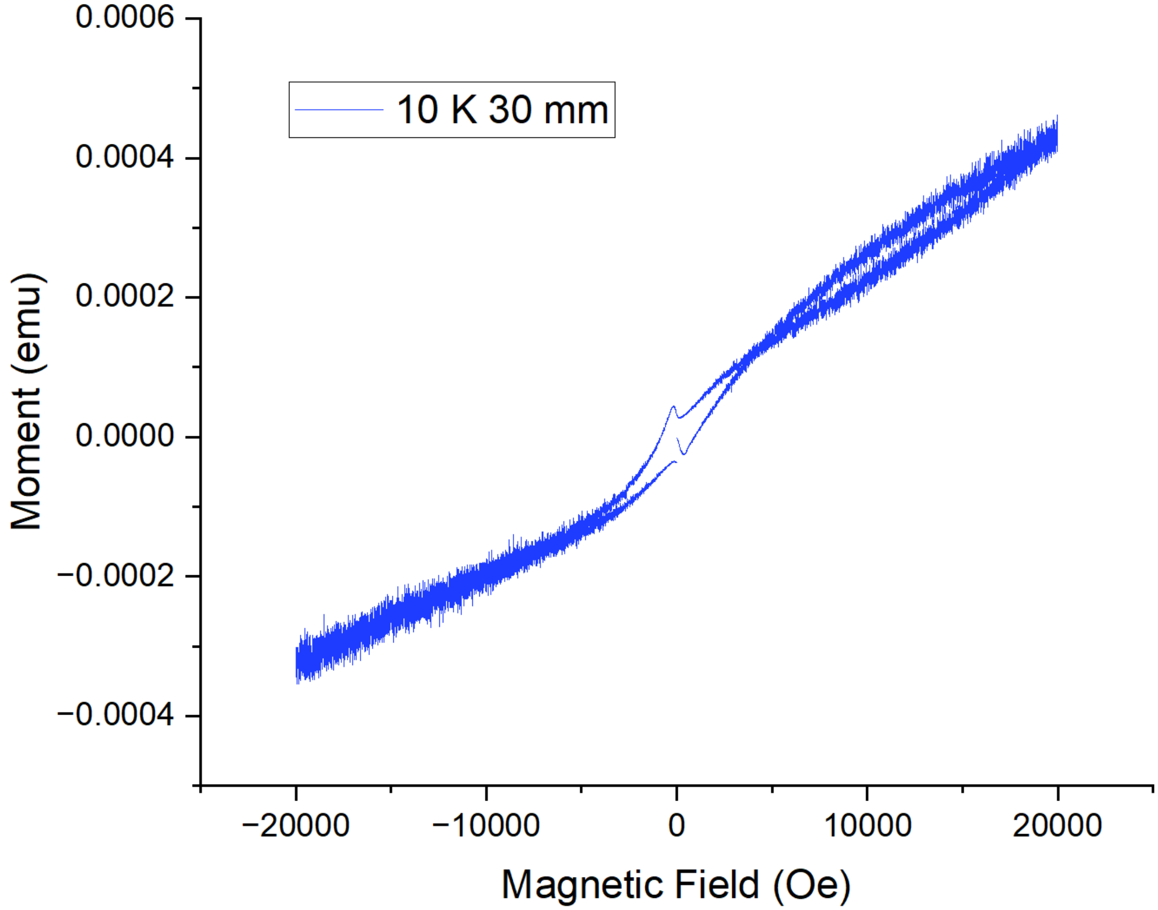

Figure 5: The MH curve of the SC Lu-H-N sample at 10 K. This is raw data without subject to any background removal. This data is in the PPM control computer data folder.

Let us delve into the significance of the results. The observation of the Meissner effect in the M-H (magnetization vs. magnetic field) curve holds profound importance as a compelling piece of evidence substantiating the existence of superconductivity in the material. The Meissner effect stands as a distinctive hallmark phenomenon of superconductivity, and its identification serves as robust confirmation of superconducting behavior.

Figure 5 illustrates the genuine manifestation of the Meissner effect in the Lu-H-N sample. In this effect, a superconducting material expels almost all magnetic flux from its interior upon transitioning to the superconducting state. This expulsion leads to a sharp decline in magnetization, resulting in the M-H curve exhibiting characteristic diamagnetic behavior (negative slope). The material becomes magnetically neutral in the superconducting state, forming a plateau where magnetization reaches a constant negative value. This section represents the lower critical field (Hc1), wherein the material maintains a fully superconducting state with no magnetic flux penetration.

For Type-II superconductors, beyond Hc1, the magnetization starts to increase (become less negative) as magnetic vortices penetrate the material (refer to figure 6). This phase continues until it reaches the upper critical field (Hc2), where the curve bends towards the magnetization axis, signifying the transition from the superconducting to the normal state. The material loses its superconducting properties and allows magnetic flux to penetrate freely. The observed hysteresis loop in figure 5, characteristic of Type-II superconductors, indicates the pinning of magnetic flux lines during the reduction of the magnetic field from above Hc2, creating a distinct loop. This is exactly what we observed in figure 5. This hysteresis loop is characteristic of Type-II superconductors.

The significance of observing the Meissner effect in the M-H curve lies in its direct correlation with the fundamental attributes of superconductivity: zero resistance and perfect diamagnetism. When the M-H curve exhibits this behavior, it not only affirms the absence of resistance (zero resistance) but also verifies the material's complete expulsion of magnetic fields—essential characteristics of superconductors. Therefore, the presence of the Meissner effect in the M-H curve stands as highly significant and compelling experimental evidence that strongly supports the assertion of superconductivity in the material. It provides direct empirical confirmation of the superconducting state and serves as a fundamental criterion for identifying and characterizing superconductors.

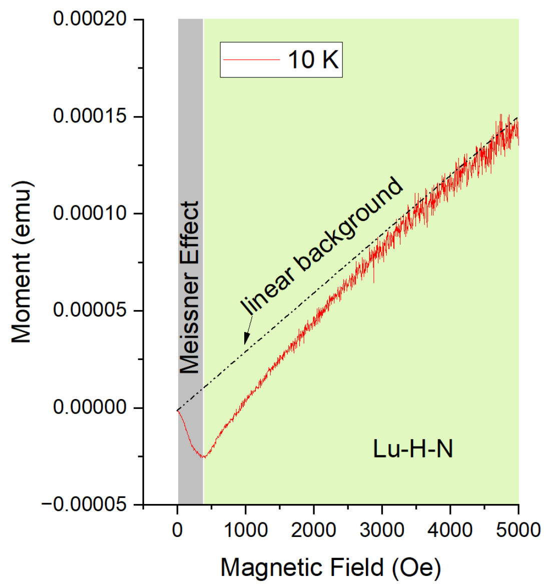

Figure 6: One part of the MH curve of the SC Lu-H-N sample at 10 K, identifying the different part of the signal. The gray area represents the area that shows the true Meissner effect and one the applied field hits the Hc1 how it changed the direction. This data is in the PPM control computer data folder.

The data presented above provides compelling evidence of superconductivity. Nonetheless, a potential counterargument may emerge, suggesting that the observations were made at 10 K, hinting at a critical temperature (Tc) around 15 K. This could imply the presence of a known superconductor with a low Tc. It is crucial to emphasize, however, that the sole constituents of the sample are lutetium (Lu), hydrogen (H), nitrogen (N), and oxygen (O). It is firmly established that none of these elements exhibit superconductivity under the specified pressure (P) and temperature (T) conditions. To fortify our findings, let us scrutinize another M-H curve of the same sample, this time taken at 30 K.

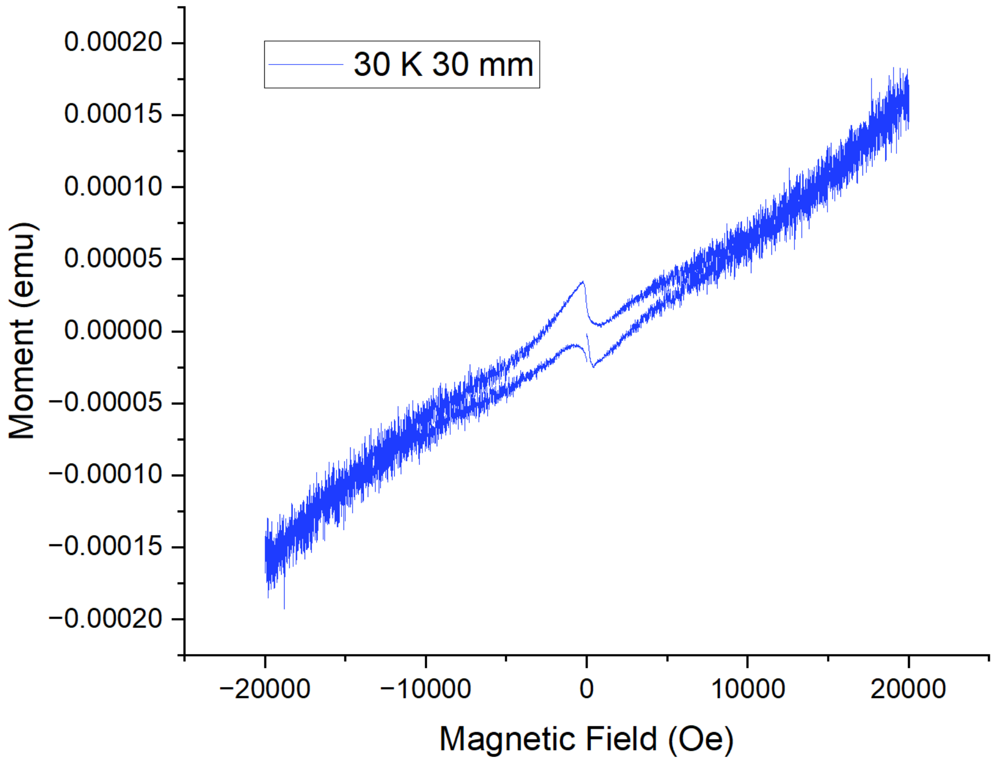

Figure 7: The MH curve of the SC Lu-H-N sample at 30 K. This is raw data without subject to any background removal. This data is in the PPM control computer data folder.

As evidenced, we have similarly detected the authentic Meissner effect in the Lu-H-N sample at 30 K. None of the materials within the sample exhibit a critical temperature (Tc) exceeding 30 K. The data presented above undeniably affirms the existence of superconductivity in the Lu-H-N system.

As mentioned earlier, the pronounced heterogeneity in the sample—marked by a diverse array of phases and subtle variations within individual phases—mandates the precise establishment of an accurate background. Through multiple experimental iterations, it was determined that the optimal distance for this specific experiment stood at 30 mm. This determination followed a systematic exploration of various distances, where even at 32 mm, a discernible slope difference emerged at low temperatures. However, the response from the non-superconducting segment of the sample proved predominant. It is crucial to underscore that in such a heterogeneous sample environment, the signal originating from regions distant from the superconducting (SC) phase serves as the most effective background reference to discern the genuine response from the sample.

It is noteworthy that the data presented above underwent no background removal; the plots are grounded in raw data. Despite the absence of background subtraction, the transition is conspicuously visible, affirming that the superconducting phase was optimally positioned at the correct distance. This transparency in the raw data underscores the presence and consequential influence of the superconducting phase on the overall sample behavior.

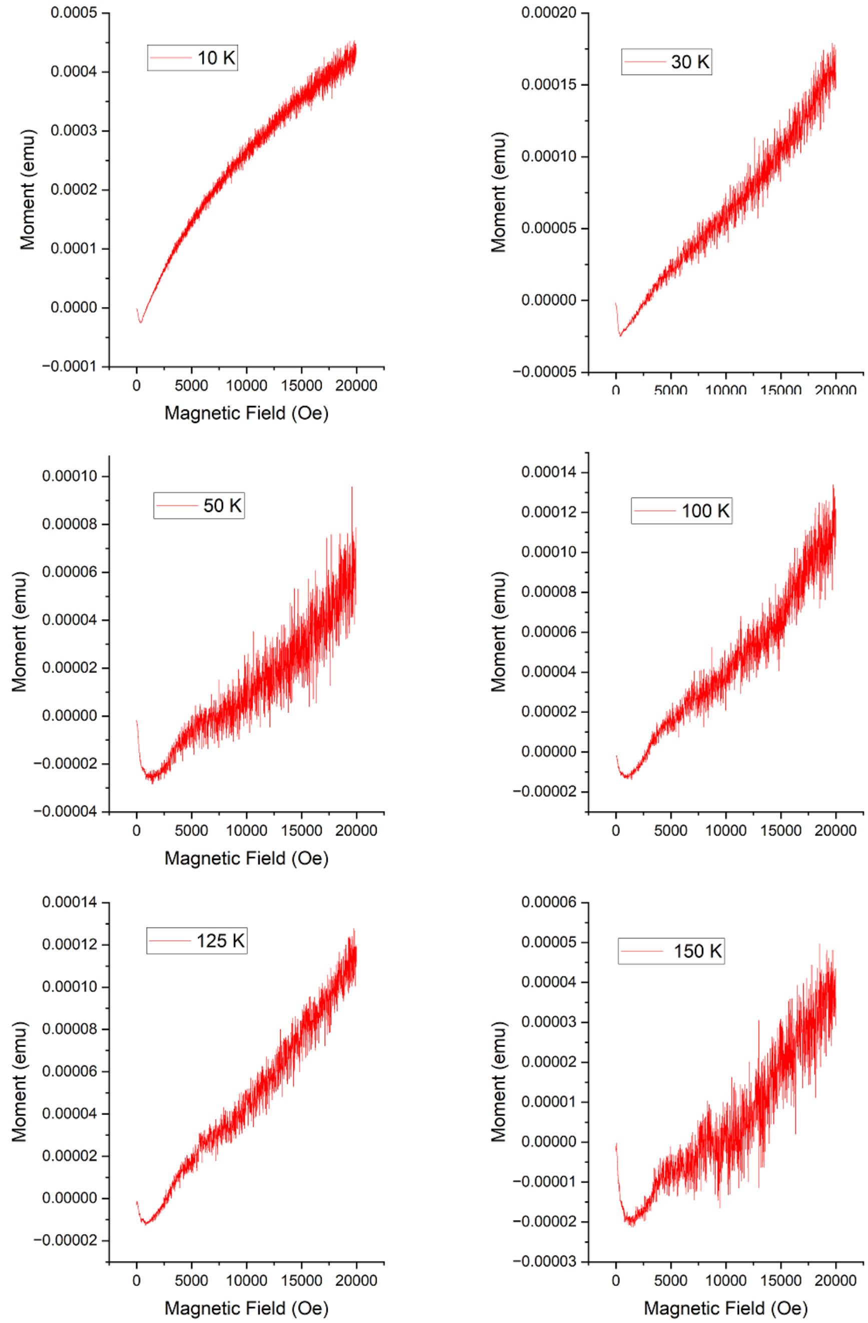

Figure 8: The MH curve of the SC Lu-H-N sample at different temperatures. This is raw data without subject to any background removal. Clearly showing the Meissner effect. This data is in the PPM control computer data folder.

In this presentation, I offer the conclusive background-subtracted M-H plot on the left, accompanied by the depiction of the lower critical field (Hc1) at different temperatures. The outcome of this analysis reveals a lower critical field (Hc1) value of 248 Oersted.

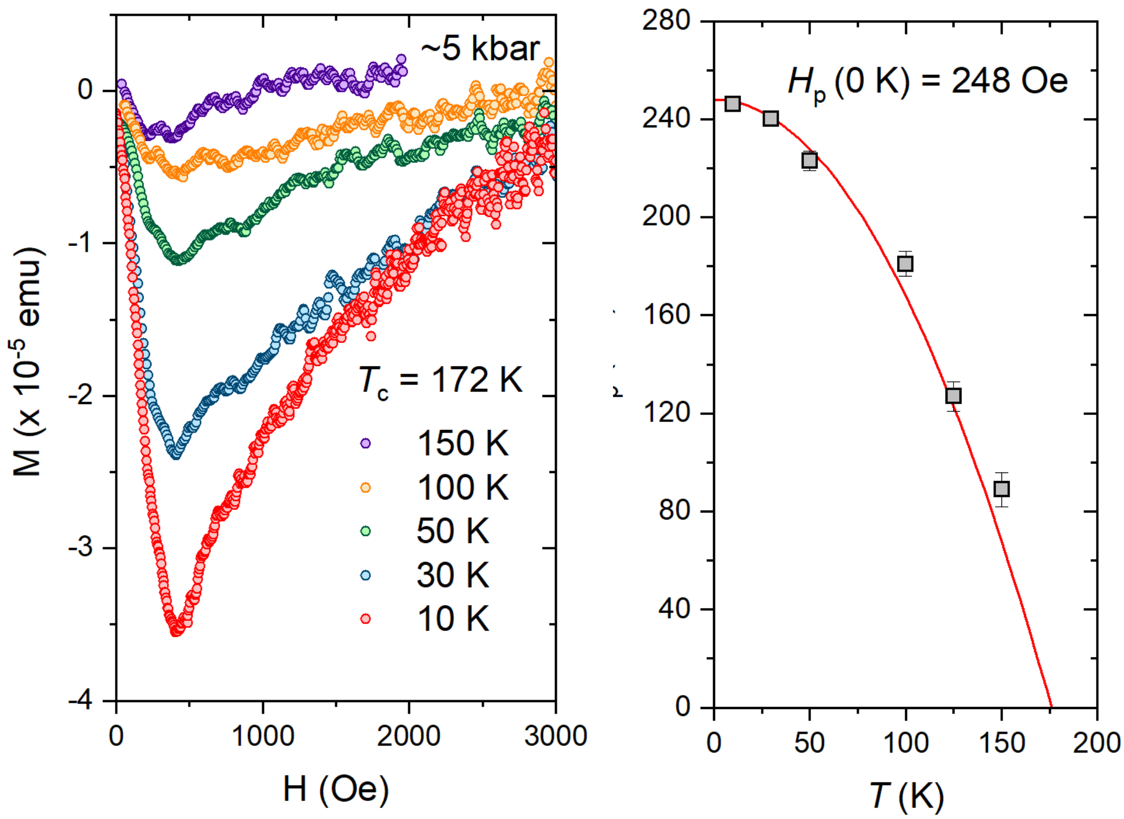

Figure 9: Left: The MH curve of the superconducting Lu-H-N sample at different temperatures, clearly showing the Meissner effect. Right: Hc1 vs Tc plot derived from the MH curve.

Dr. Dissanayake initially expressed excitement about these results and promptly informed my student, Hiranya Pasan, initiating a positive and enthusiastic discussion where he acknowledged the significance of these findings. However, as is characteristic of Dr. Dissanayake, he began to propose alternative interpretations, reflecting his typical lack of confidence in experiment results. It is noteworthy that this lack of confidence extended not only to our PPMS data but also in interpreting X-ray data presented in the paper. Despite repeated requests for a final analysis, there were delays in delivering the results. It was only through the intervention of collaborator Prof. Salamat, who visited Rochester to assist Dr. Dissanayake in understanding the data, that conclusive findings were eventually provided.

It is crucial to emphasize that there has been no data manipulation; the discrepancies arise from differing interpretations of the data, a natural aspect of scientific inquiry. The definitive evidence of superconductivity, as demonstrated in the MH curve above, guided my understanding of the necessary background considerations and the accurate representation of the signal from the sample.

I offer this example to illustrate the importance of discerning such nuances. The figure below (Figure 10) presents FC and ZFC data from MgB2.

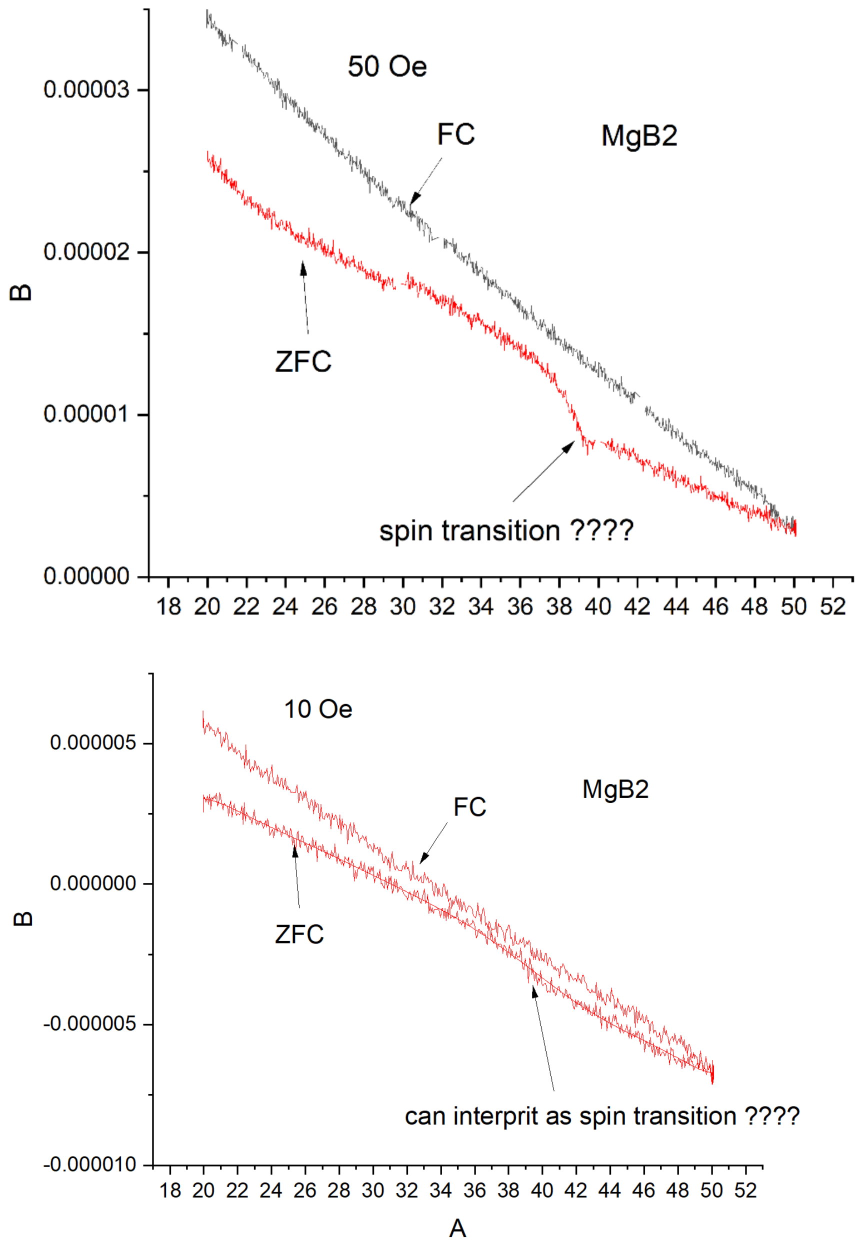

Figure 10: ZFC and Fc data on MgB2 sample. This data is in the PPM control computer data folder.

The data, as evident, could be subject to alternative interpretations, possibly suggesting a different transition, albeit one indicative of superconductivity. Given our knowledge that this sample is MgB2, a superconducting material with a critical temperature (Tc) of 40 K, we can confidently attribute this observed transition to the superconducting state. However, it's crucial to acknowledge

that if Dr. Dissanayake were studying this material without prior knowledge of its identity, there might be room for misinterpretation, potentially categorizing it as a spin glass, ferromagnetic, or similar transition based on the signal's direction.

While it's natural for skeptics to argue that the compelling data supporting superconductivity at a 30 mm distance could be influenced by background, the high-pressure cell, or be unrelated to the sample, conducting the experiment under the same conditions should not yield the same MH curve supporting the Meissner effect if this were the case. To address this, we conducted another experiment using a Lu-H-N sample under identical pressure and conditions as the previous experiment, with all variables remaining constant except for the sample itself. Figure 11 below illustrates the MH curve data at various distances from the sample, including a slightly increased distance of 29 mm. Notably, there is no discernible signature of superconductivity. This conclusive demonstration unequivocally establishes that the observed data genuinely represent the characteristic excitation of the superconducting phase in the Lu-H-N sample.

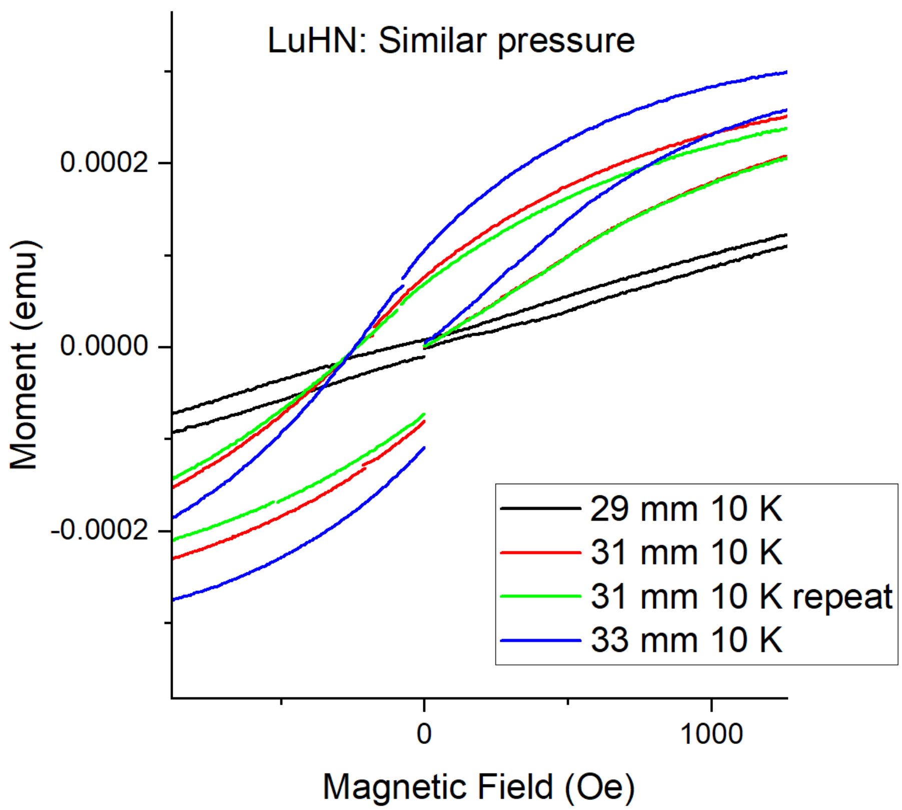

Figure 11: MH curve on Lu-H-N sample at same conditions as before at different distances. This data is in the PPM control computer data folder.

I have elucidated the imperative need for accurately establishing the correct background when dealing with samples characterized by a high degree of heterogeneity—comprising a mix of numerous phases and even minor variations within individual phases. In accordance with this understanding, we executed several experiments where superconductivity was not observed,

primarily due to the unavailability of the correct Lu-H-N sample. However, a new sample came to light, distinctly exhibiting the Meissner effect, albeit at a distance of 29 mm this time. The experimental conditions mirrored those of the prior sample where superconductivity was observed, with the sole distinction being the distance, now a mere 1 mm difference.

Once again, in this sample, the presence of other phases and the corresponding signals from those phases manifested more prominently. I direct your attention to Figure 12 below, elucidating the superconducting transition at a 29 mm distance.

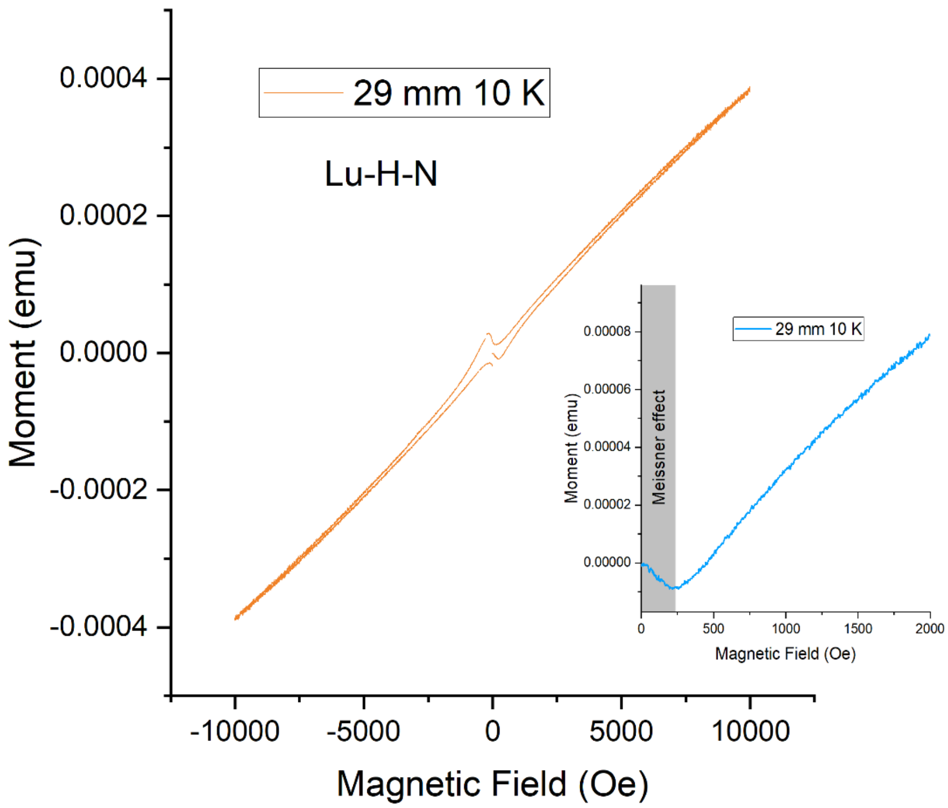

Figure 12: The MH curve of the SC Lu-H-N sample at 10 K. This is raw data without subject to any background removal. The inset shows the one part of the MH curve of the SC Lu-H-N sample at 10 K, identifying the different regions in the signal. The gray area represents the area that shows the true Meissner effect and one the applied field hits the Hc1 how it changed the direction. This data is in the PPM control computer data folder.

The rationale behind selecting the 29 mm distance and utilizing the signal originating away from the sample as the background reflects the most effective approach for identifying the signal embedded within the background. This practice seamlessly aligns with established procedures in our field and draws parallels to infrared absorption studies conducted under pressure.

In the domain of IR absorptions, background subtraction is imperative for precisely identifying the correct peaks. A technique commonly employed in high-pressure research involves maintaining a

constant pressure while varying the temperature to bring the sample to a different state, subsequently utilizing this as the background. This ensures consistency in the sample's thickness—a critical factor in IR signal analysis. Analogously, our study adopted a similar approach. Dealing with a complex, multi-domain, multi-phase sample where one phase exhibited superconductivity, we aimed to eliminate the background originating from the non-superconducting portions of the sample. To achieve this, we gathered responses away from the sample itself and employed them as our background. This strategy closely approximates the true background under those specific conditions, resulting in more precise and reliable results.

The same methodology was applied during the data analysis of the ZFC and FC experiments. In this experiment, a distance of 29 mm was identified as the appropriate measurement point, while the range of 32 to 33 mm provided a suitable background signal. Figure 13 below illustrates the ZFC and FC data after background subtraction.

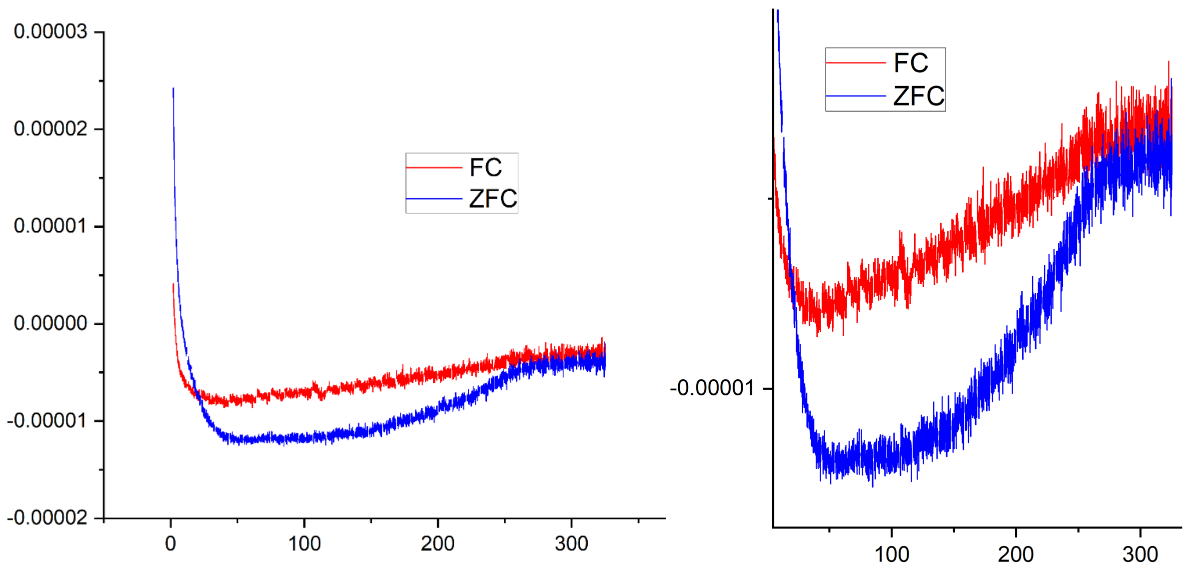

Figure 13. Top: Magnetic susceptibility (χ = M/H, where M is magnetization and H is magnetic field) as a function of temperature under conditions of zero field cooling (ZFC) and field cooling (FC) at D.C. field of 60 Oe. bottom: Zoomed version of the same plot.

If this approach were erroneous or susceptible to artifacts, we would anticipate consistently obtaining a superconducting signal whenever applying this method. Contrary to this expectation, as illustrated in Figure 14 below, a comprehensive data analysis on the sample reveals no evidence of superconductivity under identical conditions. The sole disparity lies in the absence of a superconducting phase during the experiment.

In assessing the viability of our approach, it is crucial to consider the Investigating Committee's apparent lack of expertise in high-pressure low-temperature superconductivity experimental research. Their focus on shock physics, while undoubtedly valuable within its domain, introduces

a nuanced challenge when evaluating methodologies specific to our field. The intricacies of accurately establishing backgrounds in samples characterized by a high degree of heterogeneity, as well as the utilization of signal origin away from the sample, align with practices prevalent in our research but may appear unconventional from the Investigation Committee's perspective rooted in shock physics.

This divergence in research focus becomes particularly evident when examining the Committee's assertions. If they were accustomed to the subtleties of high-pressure low-temperature superconductivity research, they might recognize the legitimacy of our chosen approach. Instead, their misinterpretation of our methods, such as the unsubstantiated claim of subtracting 29 mm from 33 mm and inverting the signal, underscores a lack of familiarity with the nuances inherent in our field.

It is imperative for the Investigation Committee to acknowledge these nuanced differences and exercise caution in drawing conclusions outside their primary area of expertise. A more thorough understanding of the intricacies of high-pressure low-temperature superconductivity research would enhance the credibility of their analysis and dispel any unwarranted skepticism about our methodologies.

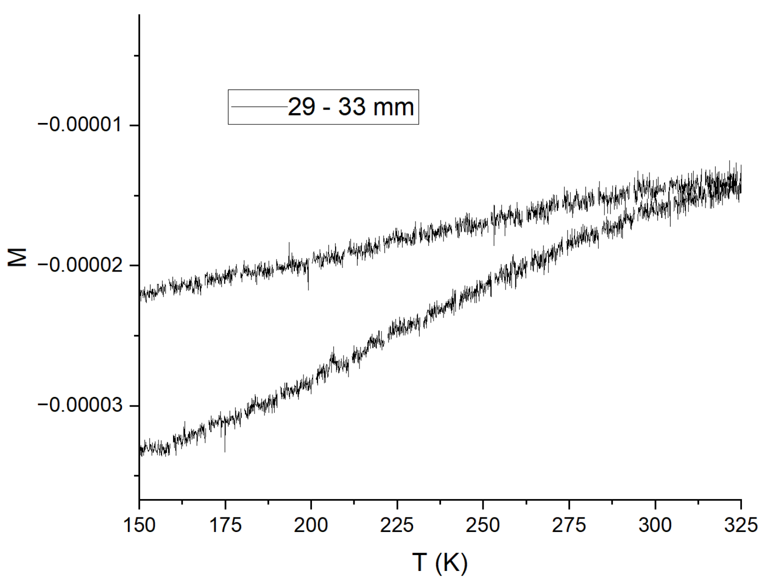

Figure 14. Magnetic susceptibility (χ = M/H, where M is magnetization and H is magnetic field) as a function of temperature under conditions of zero field cooling (ZFC) and field cooling (FC) at D.C. field of 60 Oe. No superconductivity observed. The 33 mm signal used as background, which was same as what we did in the previous experiment. This data is in the PPM control computer data folder.

It is crucial to acknowledge that the ZFC and FC data were affected by the pronounced inhomogeneity and the presence of other magnetic responses. In response to this challenge, we meticulously identified the 29 mm region as the optimal location for the superconducting sample, relying on the insights gained from M-H curve measurements. We strategically utilized data

acquired from regions distant from the superconducting area as background, encompassing other magnetic responses, and subsequently applied subtraction. This methodology aligns with common practices in our field, and it is pertinent to recognize that many research papers in literature lack exhaustive details about their measurements. Numerous instances of such practices can be found in the existing body of literature. I refer you to the following:
https://arxiv.org/abs/2201.05137; https://arxiv.org/abs/1506.08190.

e. Conclusion in Response to Accusation No. 5.

In addressing the four claims made by the Investigation Committee, which all center around the incorrect assertion that the actual superconducting signal originates from the 32-millimeter distance, it is evident that these claims are unfounded. The raw magnetization data, ZFC and FC curves, and published FC data were not incorrectly reported, fabricated, or derived from sequestered data. The misconception stems from the misinterpretation of the background signal, which is not the superconducting signal but rather arises from other inhomogeneous phases and external factors.

I feel compelled to shed light on Dr. Dissanayake's involvement and the discrepancies in his findings, as the Investigation Committee seems to heavily rely on his input. Despite his claimed expertise in X-ray and neutron diffraction, errors in his analyses are evident. The synthesized Lu-H-N samples, characterized by pronounced heterogeneity, presented challenges in identifying the specific phase inducing superconductivity. Dr. Dissanayake's analyses, especially concerning the gamma phase, led to erroneous conclusions about a cubic superhydride (LuH8), later identified as Lu2O3 through Raman spectroscopy.

Transparency in acknowledging errors is crucial in scientific endeavors. Dr. Dissanayake's influence on students and his work ethic issues further raise concerns about his reliability. Instances of fundamental misunderstandings and lack of confidence in results call into question his suitability for scientific discourse. My decision to explore alternative positions outside my group in 2023 was rooted in dissatisfaction and a lack of confidence in Dr. Dissanayake's abilities.

Moving to the PPMS VSM data, the discrepancies in interpretation arise from the highly heterogeneous nature of the samples. The Meissner effect observed in the M-H curve at 10 K and 30 K provides compelling evidence of superconductivity. Contrary to the Investigation Committee's accusations, there is no data manipulation; rather, the differences stem from varied interpretations inherent in scientific inquiry. The figure illustrating FC and ZFC data from MgB2 serves as an example of potential misinterpretation based on data alone.

Addressing the PPMS VSM data specifically, the true Meissner effect, observed at different temperatures, is a robust confirmation of superconductivity in the Lu-H-N system. The meticulous background establishment, even without background subtraction, emphasizes the genuine influence of the superconducting phase on the overall sample behavior.

In conclusion, the claims made by the Investigation Committee lack a solid foundation, and the evidence presented supports the existence of superconductivity in the Lu-H-N system. The detailed

analyses, acknowledgment of errors, and adherence to scientific rigor contribute to the credibility of our findings, despite the challenges posed by the complex nature of the samples.

The credibility concerns arising from the Investigation Committee's failure to thoroughly examine the details and nuances of our research have been highlighted. The conclusion underscores the need for the Investigation Committee to reconsider their approach, recognizing the specialized nature of our research and the importance of a more nuanced understanding. This reevaluation is essential to dispel baseless accusations and ensure a credible and informed analysis of the ZFC and FC M(T) data in the specified figures of the LuHN Nature 2023 paper.

* * *

6. Figure 3b, M(H) Data (Magnetic Moment as a Function of Applied Magnetic Field) Was Not Fabricated nor Falsified.

My response herein collectively addresses all four claims wrongly made by the Investigation Committee as all the claims relate to the same issue i.e. I produced a signal with the expected signature of a bulk superconducting transition to convince co-authors and Nature referees and editors that LuH exhibits genuine room-temperature superconducting behavior under a modest pressure of ~10 kbar.

a. The M(H) Data Was Not Fabricated.

b. The Sequestered Data is Not in Contrast to the Published Data.

c. The Published Data Was Not "Derived" from the Sequestered Data.

d. The M(H) Curves Were Not Fabricated.

While examining the significance and evaluating the evidence supporting superconductivity in our PPMS data, it is imperative to shed light on the involvement of Dr. Dissanayake, our research scientist, and to address certain discrepancies in his findings. This is important because it appears that the Investigation Committee has placed a great deal of reliance on Dr. Dissanayake.

To gain a comprehensive understanding of the materials under scrutiny, Dr. Dissanayake was enlisted due to his then self-claimed specialized expertise in X-ray diffraction and neutron diffraction. Our primary research goal was to identify the specific phase responsible for inducing superconductivity in the Lu-H-N system.

The synthesized Lu-H-N samples present a challenge due to their pronounced heterogeneity, comprising various phases and subtle variations. When dealing with samples of such pronounced inhomogeneity, the superconducting signal can easily become obscured by signals originating from other phases within the sample. Notable among these phases are LuH_3 (trigonal), LuH_2 (cubic), LuH_{2+} (with numerous variations), LuN, LuN_1-x (exhibiting variations), LuH_2+N_1-x (also showing variations), and Lu_2O_3. The identified stoichiometry for superconductivity is $LuH_{2.2}H_{0.72}$.

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Unfortunately, it is crucial to acknowledge errors in Dr. Dissanayake's analyses. Dealing with samples of such heterogeneity, the superconducting signal can be obscured by signals from other phases, and Dr. Dissanayake's findings have encountered discrepancies.

In his X-ray studies, three distinct phases were identified as alpha, beta, and gamma, all exhibiting cubic symmetry. While alpha was confidently identified as LuH_3, the remaining two phases, conforming to the Fm3m structure, remained unknown. Dr. Dissanayake's analysis of the gamma phase, characterized by a lattice parameter of 5.18 Å, led to an intriguing but erroneous breakthrough.

Dr. Dissanayake proposed a cubic phase with a lattice parameter of 5.18 Å as a superhydride (LuH_8) under ambient pressures, presenting it as a significant discovery. He asserted that this marked the first instance of a superhydride manifesting itself under ambient pressures. While I harbored some initial skepticism due to the seeming incredibility of the claim, I opted to embrace his discovery, given his self-professed expertise in X-ray diffraction and neutron diffraction. In his customary fashion, he meticulously prepared a PowerPoint presentation and articulated his argument. He was resolute in his belief that the cubic phase with a lattice parameter of 5.18 Å represents a superhydride, specifically LuH_8, grounded in a volumetric rationale. Please refer to the accompanying figure 1 from his presentation for visual elucidation.

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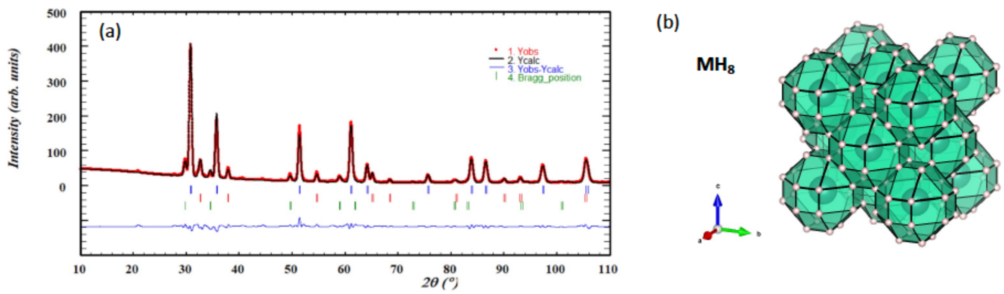

Figure : (a) Rietveld refinement of the x-ray powder diffraction data collected using Rigaku XtaLAB Synergy using micro powder diffraction mode. The red points, black line and blue line represent the observed data, calculated intensity and the difference between observed and calculated intensities. Blue, red and green tick marks represents expected Bragg peak positions for MH_3, high pressure state MH_x and super-hydride MH_8 respectively. (b) Crystal structure of MH_8 with clathrate cage formed by hydrogen atoms.

We called these 3 phases alpha phase, beta phase and gamma phase

Volume/ Red Metal ion = 29.83 Å³

Alpha phase is most likely MH_3, Fm-3m space group, a=5.022 Å. Metal ion is at (0,0,0) (4a).
Therefore, the volume/M ion = 5.022^3/4 = 31.82 Å³
ΔV= 31.82-29.83=1.99 Å³
5.0192287

Phase transformation in lutetium metal at 88 GPa

The following MUEOS fits for lutetium were obtained using ambient pressure volumes $V_0(\text{hcp})=29.833$ Å^3/atom and $V_0(hR24)=28.341$ Å^3/atom.

Pressure range 0–93 GPa:

$V_0=29.833$ Å^3/atom

$B_0=52.30$ GPa, $B_0'=1.943$, and $\beta=5.685$

H	a	c
0	4.892348116	
2		
3	5.019228754	
4	5.004448091	
	5.650798672	
6I	6.058073165	
	4.283704616	
6F	5.019230308	
8F	5.66142476	
8I		

Beta phase can also fit well with Fm-3m space group, a=4.744 Å. Metal ion is at (0,0,0) (4a).
Therefore, the volume/M ion = 4.744^3/4 = 26.82 Å³

Note : Fm-3m and F-43m, has same structure factor for metal ion.
We can also obtain transformation to I4/mmm space group with $a = b = \frac{a_{cubic}}{\sqrt{2}}$ and $c = acubi_c$
***** ΔV= delta_V=26.82-29.83= -3.01 Å³**

Gamma phase can also fit well with Fm-3m space group, a=5.188 Å. Metal ion is at (0,0,0) (4a).
Therefore, the volume/M ion = 5.188^3/4 = 31.82 Å³
ΔV= delta_V=35.1-29.83= 5.27 Å³
This makes Gamma phase H content according to the volume change = 3/1.99x5.27 = 7.94~= 8

Same note about F-43m and I4/mmm still valid.

Figure 1. Power point slides from Dr. Dissanayake's presentation, which he used to describe his breakthrough discovery.

Our research team dedicated approximately six months to isolating and assessing the superconductivity of the gamma phase. Despite obtaining a substantial portion of the sample, no traces of superconductivity were detected. This raised doubts about the accuracy of the phase loaded into the Diamond Anvil Cell (DAC). Compounding this issue was the inability to conduct X-ray measurements under pressure at the University of Rochester's X-ray facility.

Considering these challenges, a strategic decision was made to shift our focus towards Raman spectroscopy. This technique, proven effective for low Z materials, offered insights into vibrational

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modes within the sample, including contributions from hydrogen. Despite the complexities involved, our student, Hiranya, successfully obtained spectra for the gamma phase.

Upon reviewing the spectra, distinct features characteristic of an oxide compound were identified. Oxides typically manifest strong and symmetric peaks in their Raman spectra. Leveraging my extensive experience with Raman spectroscopy, the nature of the phase was ascertained, leading to the recommendation for Dr. Dissanayake to scrutinize the gamma phase for confirmation, subsequently identified as Lu_2O_3.

This incident underscores a fundamental lapse in crystallographic judgment, particularly in the verification process of new crystal structures, especially concerning phases like oxides. Such oversights pose significant concerns, particularly in high-pressure studies where discerning results with imperfect data is critical.

Furthermore, ethical concerns arise from Dr. Dissanayake's request for non-disclosure of this matter, especially to Professor Salamat. Given the substantial allocation of resources and time based on the assertion of discovering a new superhydride (LuH_8), confidence in Dr. Dissanayake's rational and analytical thinking has been unequivocally eroded.

This incident highlights the importance of transparency and rigorous scrutiny in our research endeavors. Had I not insisted on obtaining the Raman spectra of the gamma phase, it is conceivable that the erroneous assertion of it being a superhydride might have persisted. Addressing these concerns openly is essential to maintaining the integrity of the investigations.

During the analysis of Raman spectra, a parallel situation unfolded. Dr. Dissanayake confidently stated that the spectrum presented in Figure 2 originated from the LuH3 hexagonal phase—a phase acknowledged for its stability under ambient pressure and commercial availability.

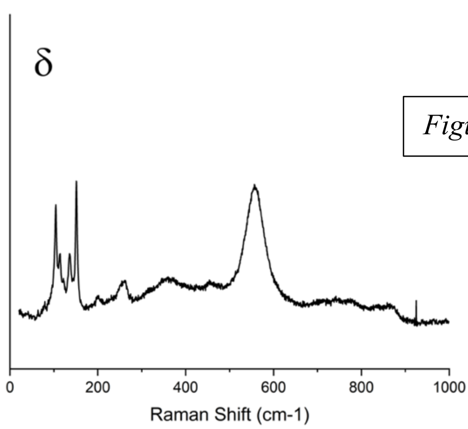

Figure 2. Raman spectra of LuH3.

As is customary, Dr. Dissanayake presented a PowerPoint to support his conclusions. However, I explicitly communicated to him that aligning peak positions in a potential structure with collected data does not inherently validate a structural representation's accuracy. Conversely, I stressed the heightened informativeness of Raman spectroscopy in understanding the unidentified material. Personally conducting factor group analysis, I identified four phonon modes expected for the hexagonal P63/mmc structure. In the Raman spectra, 14 discernible peaks were observed, with

meticulous peak fitting providing unwavering confidence in 17 anticipated peaks. Consequently, the hexagonal structure is firmly excluded as plausible. As of today, I am under the impression that he still maintains the belief that the Raman spectra mentioned above originate from Hexagonal LuH3.

This marks the second instance of Dr. Dissanayake's fundamental misunderstandings. Disturbingly, he influenced students like Hiranya with flawed conclusions, necessitating my intervention. These incidents, substantiated by concrete evidence, are not isolated; additional comprehension issues surfaced. My discontent extends to his work ethic—arriving late, leaving promptly at 5 PM, and habitually presenting reasons to evade assigned tasks. For instance, when Professor Russell Hemley identified a potential structure exhibiting high Tc superconductivity (possible supercell), I instructed Dr. Dissanayake to examine our data collected at the Advanced Photon Source (APS) under high pressure and low temperatures. He prematurely dismissed the possibility of low-angle peaks corresponding to a supercell, only to acknowledge them upon reevaluation when it was evident that there were indeed three discernible low-angle peaks at 3.8, 4.5, and 5.6 Å. By summer 2023, my dissatisfaction with Dr. Dissanayake led to the decision to explore alternative positions outside my group. This decision was rooted in my lack of confidence in Dr. Dissanayake as well as his inflexibility in scientific discourse, persistently defending his correctness regardless of circumstances.

I would like to address the Investigation Committee's accusations regarding the PPMS VSM data.

While Dr. Dissanayake initially expressed excitement about the PPMS data, he later presented alternative interpretations, consistent with his history of misunderstanding the data. This behavior may reflect a broader confidence issue and a tendency to question results even after validation. It is crucial to acknowledge that scientific interpretation can vary, and differing perspectives are inherent in scientific discourse.

It is important to clarify that the discrepancies in interpretation arose due to the highly inhomogeneous nature of our samples and the challenges associated with obtaining accurate measurements with larger samples, as opposed to the DAC experiments where diamonds were utilized. In the PPMS measurements, which require significantly larger samples, we employed a clamp cell configuration that did not involve diamonds. The use of larger samples introduced a high degree of heterogeneity, characterized by a mixture of numerous phases and subtle variations within individual phases. Commonly observed phases include LuH3 (trigonal), LuH_2 (cubic), LuH_{2+} (with numerous variations), LuN, LuN_{1-x} (exhibiting variations), $LuH_{2+}N_{1-x}$ (also showing variations), and Lu_2O3, necessitating the establishment of the correct background.

During PPMS measurements, requiring significantly larger samples, we adopted a clamp cell configuration devoid of diamonds. The utilization of a larger sample size intensified the degree of heterogeneity, manifesting as a mixture of numerous phases and subtle variations within individual phases. Noteworthy among these phases are LuH3 (trigonal), LuH_2 (cubic), LuH_{2+} (with numerous variations), LuN, LuN_{1-x} (exhibiting variations), $LuH_{2+}N_{1-x}$ (also showing variations), and Lu_2O3, underscoring the critical need to establish the correct background.

In our examination of the M-H curve, a distinct superconducting signal with a Tc (critical temperature) of approximately 172K was observed, albeit partially obscured by background noise. This realization emerged through experiments conducted at various positions within the notably capacious sample chamber (depicted by the orange area in Figure 3 on the left). The chamber was maximally packed, considering the potential limitation of the superconducting (SC) phase quantity. Pressure determination relied on the manufacturer-provided chart (refer to Figure 3 on the right), and Figure 4 illustrates the potential distribution of multiphase components within the sample chamber. Accurate cell placement was crucial, as an erroneous position would lead to the dominance of background signals from non-superconducting regions. Hence, establishing the precise sample position and utilizing other positions for background measurements became imperative, and this approach was rigorously adhered to. Any signal originating outside the SC region was unequivocally treated as background noise.

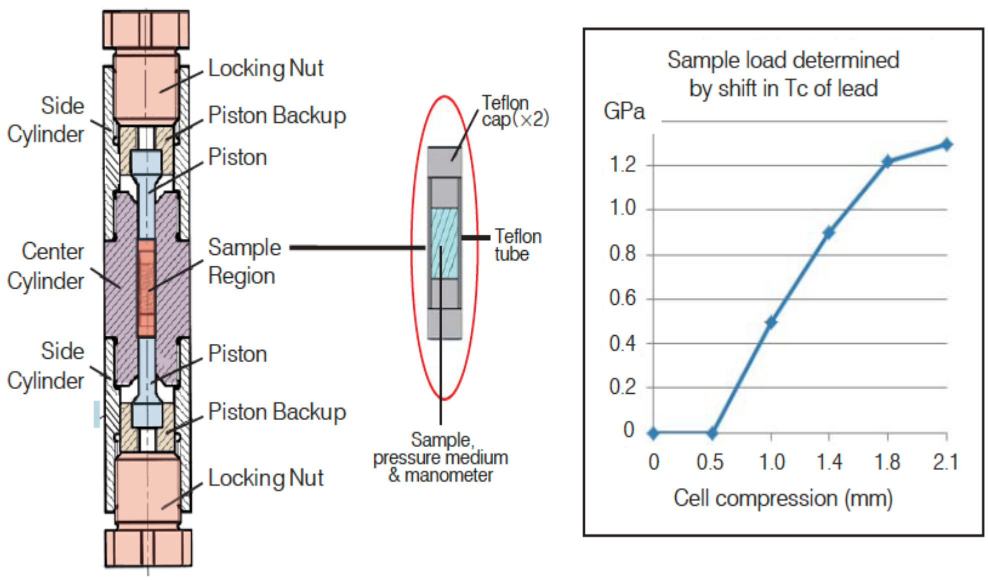

Figure 3: The high-pressure cell employed for VSM measurements. The left side illustrates the schematic of the cell, while the right figure displays the pressure calibration.

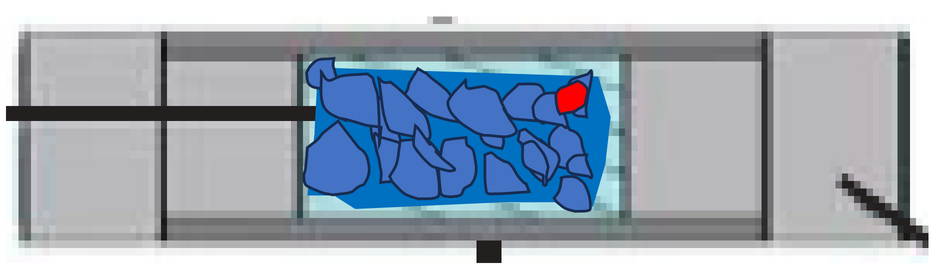

Figure 4: A magnified view of the sample chamber within the pressure cell, along with an illustration of the multiphase sample chamber. The highlighted red piece denotes the superconducting phase.

Examining the data, the following figure presents the complete MH curve at 10 K, with the identified position of the superconducting (SC) phase within the sample at a distance of 30 mm.

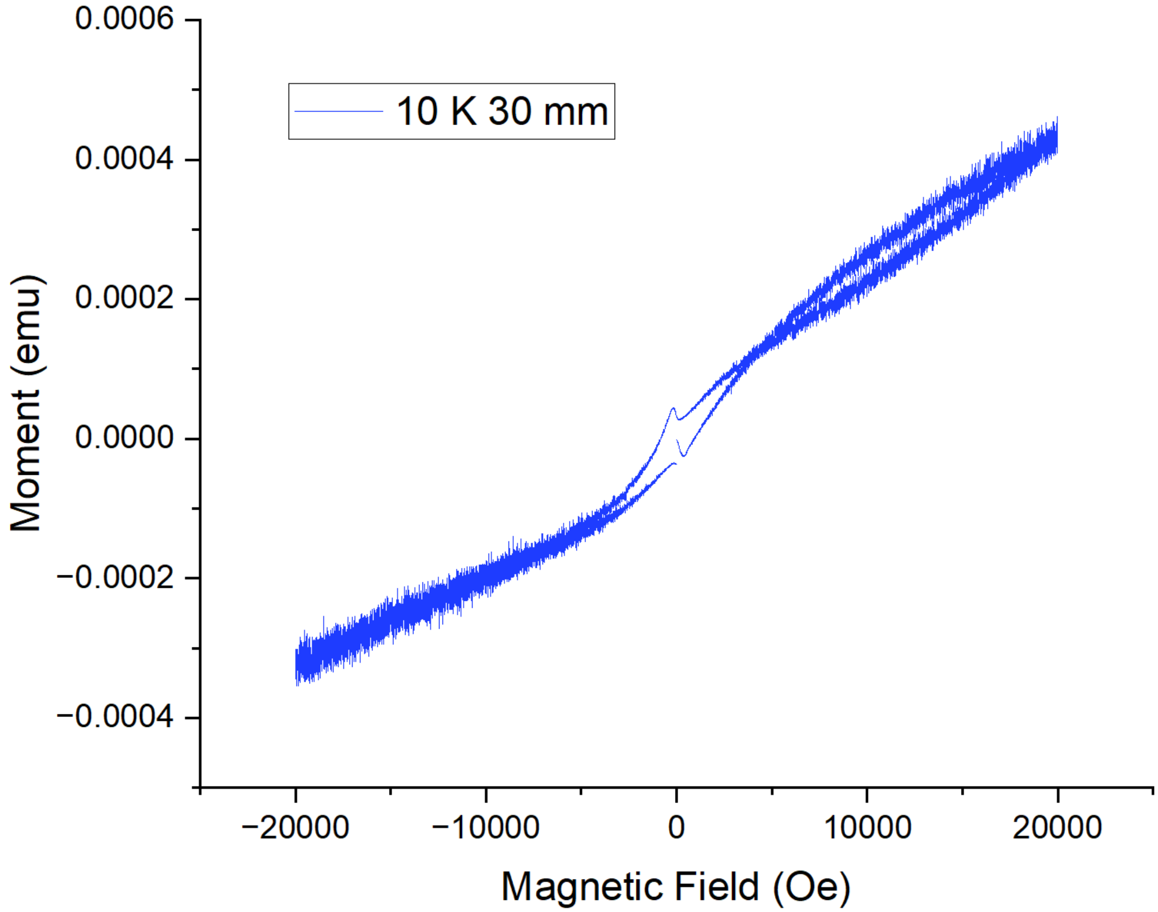

Figure 5: The MH curve of the SC Lu-H-N sample at 10 K. This is raw data without subject to any background removal. This data is in the PPM control computer data folder.

Let us delve into the significance of the results. The observation of the Meissner effect in the M-H (magnetization vs. magnetic field) curve holds profound importance as a compelling piece of evidence substantiating the existence of superconductivity in the material. The Meissner effect stands as a distinctive hallmark phenomenon of superconductivity, and its identification serves as robust confirmation of superconducting behavior.

Figure 5 illustrates the genuine manifestation of the Meissner effect in the Lu-H-N sample. In this effect, a superconducting material expels almost all magnetic flux from its interior upon transitioning to the superconducting state. This expulsion leads to a sharp decline in magnetization, resulting in the M-H curve exhibiting characteristic diamagnetic behavior (negative slope). The material becomes magnetically neutral in the superconducting state, forming a plateau where magnetization reaches a constant negative value. This section represents the lower critical field

(Hc1), wherein the material maintains a fully superconducting state with no magnetic flux penetration.

For Type-II superconductors, beyond Hc1, the magnetization starts to increase (become less negative) as magnetic vortices penetrate the material (refer to figure 6). This phase continues until it reaches the upper critical field (Hc2), where the curve bends towards the magnetization axis, signifying the transition from the superconducting to the normal state. The material loses its superconducting properties and allows magnetic flux to penetrate freely. The observed hysteresis loop in figure 5, characteristic of Type-II superconductors, indicates the pinning of magnetic flux lines during the reduction of the magnetic field from above Hc2, creating a distinct loop. This is exactly what we observed in figure 5. This hysteresis loop is characteristic of Type-II superconductors.

The significance of observing the Meissner effect in the M-H curve lies in its direct correlation with the fundamental attributes of superconductivity: zero resistance and perfect diamagnetism. When the M-H curve exhibits this behavior, it not only affirms the absence of resistance (zero resistance) but also verifies the material's complete expulsion of magnetic fields—essential characteristics of superconductors. Therefore, the presence of the Meissner effect in the M-H curve stands as highly significant and compelling experimental evidence that strongly supports the assertion of superconductivity in the material. It provides direct empirical confirmation of the superconducting state and serves as a fundamental criterion for identifying and characterizing superconductors.

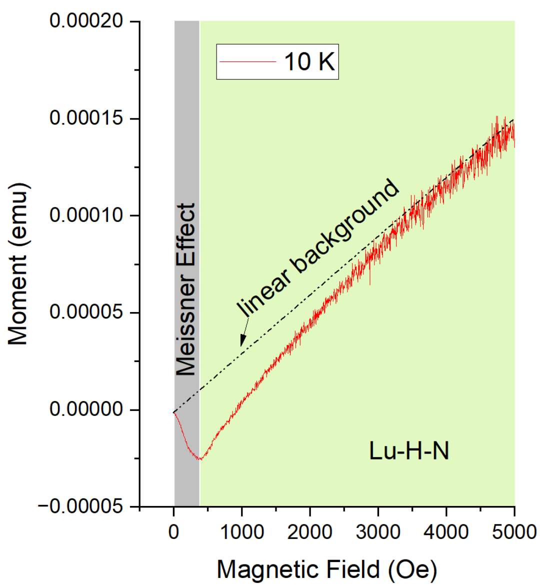

Figure 6: One part of the MH curve of the SC Lu-H-N sample at 10 K, identifying the different part of the signal. The gray area represents the area that shows the true Meissner effect and one the applied field hits the Hc1 how it changed the direction. This data is located in the PPM control computer data folder.

The data presented above provides compelling evidence of superconductivity. Nonetheless, a potential counterargument may emerge, suggesting that the observations were made at 10 K, hinting at a critical temperature (Tc) around 15 K. This could imply the presence of a known superconductor with a low Tc. It is crucial to emphasize, however, that the sole constituents of the sample are lutetium (Lu), hydrogen (H), nitrogen (N), and oxygen (O). It is firmly established that none of these elements exhibit superconductivity under the specified pressure (P) and temperature

(T) conditions. Furthermore, none of the compounds such as Lu2O3 or LuN compound superconductive. To fortify our findings, let us scrutinize another M-H curve of the same sample, this time taken at 30 K.

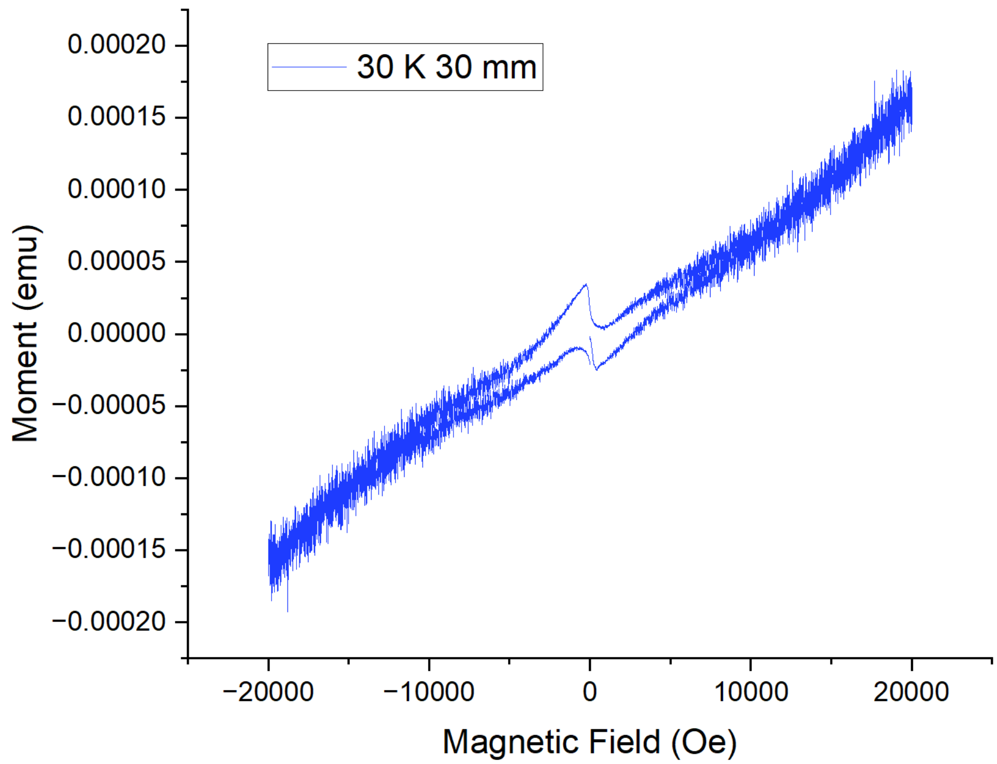

Figure 7: The MH curve of the SC Lu-H-N sample at 30 K. This is raw data without subject to any background removal. This data is in the PPM control computer data folder.

As evidenced, we have similarly detected the true Meissner effect in the Lu-H-N sample at 30 K. None of the materials within the sample exhibit a critical temperature (Tc) exceeding 30 K. The data presented above undeniably affirms the existence of superconductivity in the Lu-H-N system.

As mentioned earlier, the pronounced heterogeneity in the sample—marked by a diverse array of phases and subtle variations within individual phases—mandates the precise establishment of an accurate background. Through multiple experimental iterations, it was determined that the optimal distance for this specific experiment stood at 30 mm. This determination followed a systematic exploration of various distances, where even at 32 mm, a discernible slope difference emerged at low temperatures, and we observed the true Meissner effect at 2 K as well. However, the response from the non-superconducting segment of the sample proved predominant. It is crucial to underscore that in such a heterogeneous sample environment, the signal originating from regions distant from the superconducting (SC) phase serves as the most effective background reference to discern the genuine response from the sample.

It is noteworthy that the data presented above underwent no background removal; the plots are grounded in raw data. Despite the absence of background subtraction, the transition is

conspicuously visible, affirming that the superconducting phase was optimally positioned at the correct distance. This transparency in the raw data underscores the presence and consequential influence of the superconducting phase on the overall sample behavior.

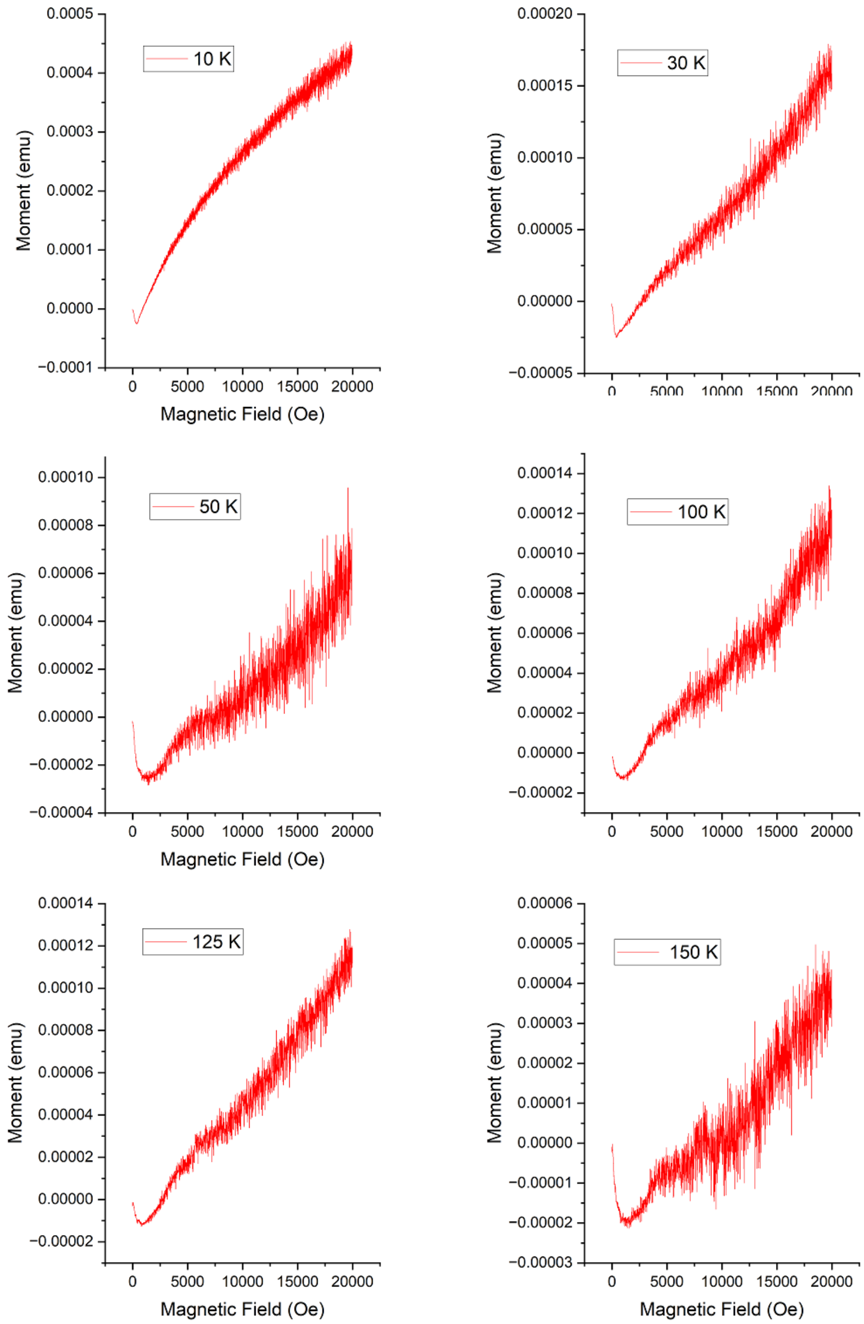

Figure 8: The MH curve of the SC Lu-H-N sample at different temperatures. This is raw data without subject to any background removal. Clearly showing Meissner effect. This data is in the PPM control computer data folder.

In this presentation, I offer the conclusive background-subtracted M-H plot on the left, accompanied by the depiction of the lower critical field (Hc1) at different temperatures. The outcome of this analysis reveals a lower critical field (Hc1) value of 248 Oersted.

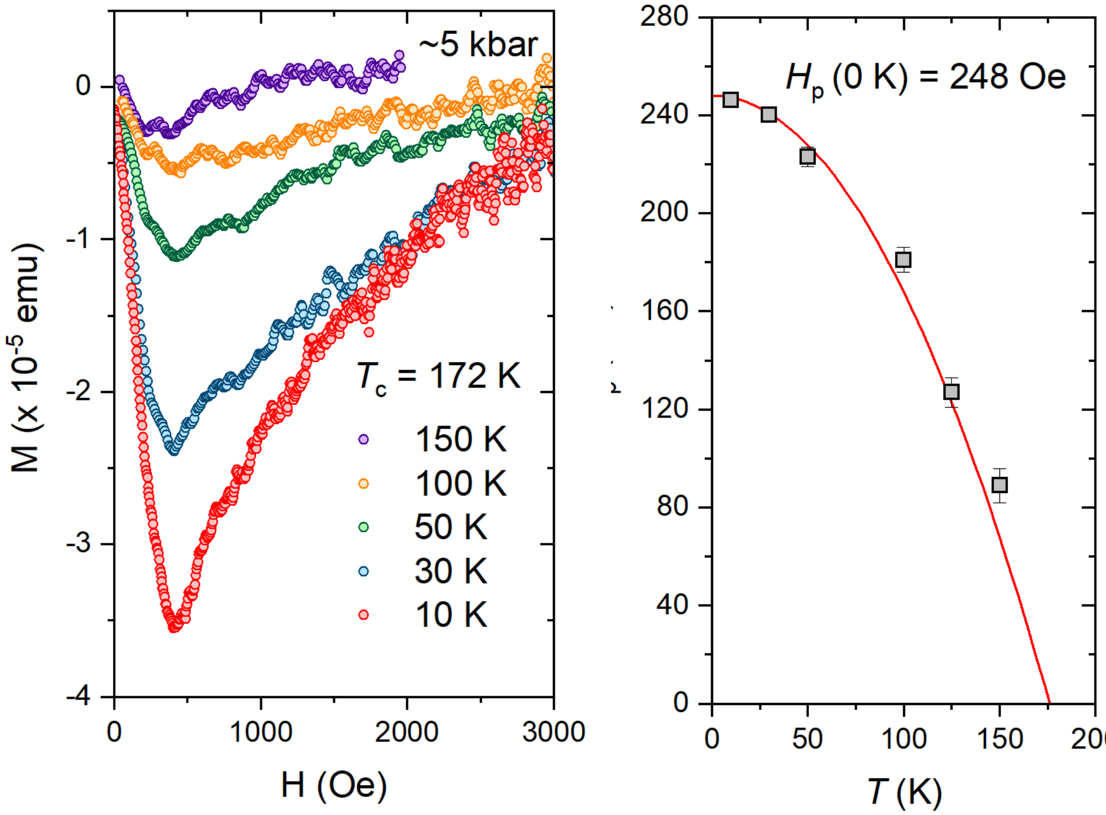

Figure 9: Left: The MH curve of the superconducting Lu-H-N sample at different temperatures, clearly showing the Meissner effect. Right: Hc1 vs Tc plot derived from the MH

Dr. Dissanayake initially expressed excitement about these results and promptly informed my student, Hiranya Pasan, initiating a positive and enthusiastic discussion where he acknowledged the significance of these findings. However, as is characteristic of Dr. Dissanayake, he began to propose alternative interpretations, reflecting his typical lack of confidence in experiment results. It is noteworthy that this lack of confidence extended not only to our PPMS data but also in interpreting X-ray data presented in the paper. Despite repeated requests for a final analysis, there were delays in delivering the results. It was only through the intervention of collaborator Prof. Salamat, who visited Rochester to assist Dr. Dissanayake in understanding the data, that conclusive findings were eventually provided.

It is crucial to emphasize that there has been no data manipulation; the discrepancies arise from differing interpretations of the data, a natural aspect of scientific inquiry. The definitive evidence of superconductivity, as demonstrated in the MH curve above, guided my understanding of the necessary background considerations and the accurate representation of the signal from the sample.

I offer this example to illustrate the importance of discerning such nuances. The figure below (Figure 10) presents FC and ZFC data from MgB2.

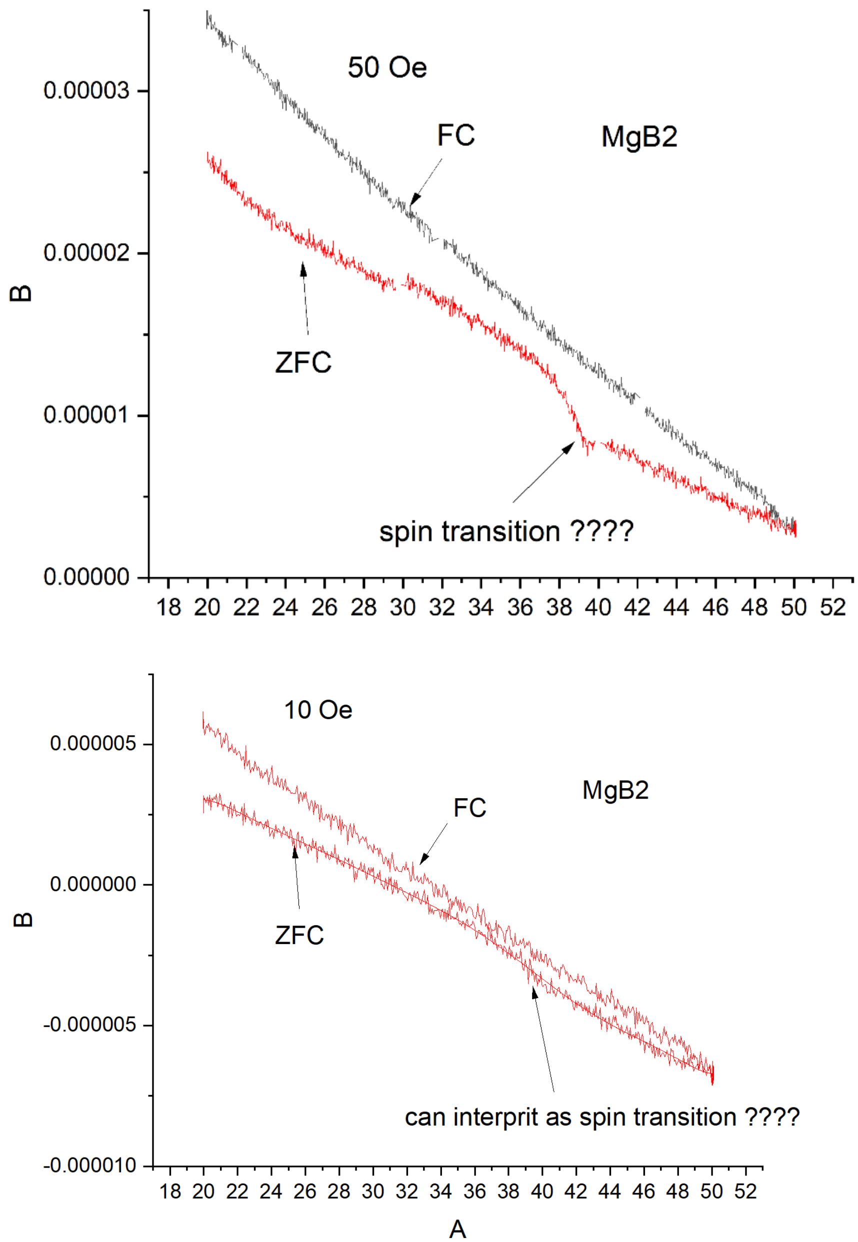

Figure 10: ZFC and Fc data on MgB2 sample. This data is in the PPM control computer data folder.

The data, as evident, could be subject to alternative interpretations, possibly suggesting a different transition, albeit one indicative of superconductivity. Given our knowledge that this sample is MgB2, a superconducting material with a critical temperature (Tc) of 40 K, we can confidently attribute this observed transition to the superconducting state. However, it's crucial to acknowledge

that if Dr. Dissanayake were studying this material without prior knowledge of its identity, there might be room for misinterpretation, potentially categorizing it as a spin glass, ferromagnetic, or similar transition based on the signal's direction.

While it's natural for skeptics to argue that the compelling data supporting superconductivity at a 30 mm distance could be influenced by background, the high-pressure cell, or be unrelated to the sample, conducting the experiment under the same conditions should not yield the same MH curve supporting the Meissner effect if this were the case. To address this, we conducted another experiment using a Lu-H-N sample under identical pressure and conditions as the previous experiment, with all variables remaining constant except for the sample itself. Figure 11 below illustrates the MH curve data at various distances from the sample, including a distance of 29 mm. Notably, there is no discernible signature of superconductivity. This conclusive demonstration unequivocally establishes that the observed data genuinely represent the characteristic excitation of the superconducting phase in the Lu-H-N sample.

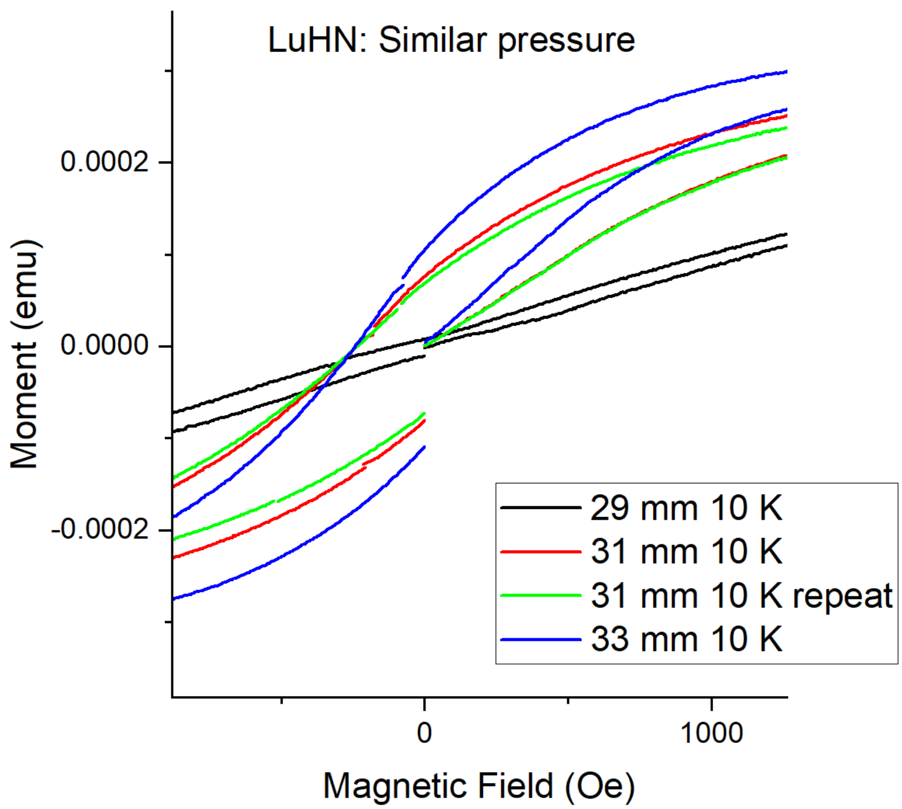

Figure 11: MH curve on Lu-H-N sample at same conditions as before at different distances. This data is in the PPM control computer data folder.

I have elucidated the imperative need for accurately establishing the correct background when dealing with samples characterized by a high degree of heterogeneity—comprising a mix of numerous phases and even minor variations within individual phases. In accordance with this understanding, we executed several experiments where superconductivity was not observed, primarily due to the unavailability of the correct Lu-H-N sample. However, a new sample came to

light, distinctly exhibiting the Meissner effect, albeit at a distance of 29 mm this time. The experimental conditions mirrored those of the prior sample where superconductivity was observed, with the sole distinction being the distance, now a mere 1 mm difference.

Once again, in this sample, the presence of other phases and the corresponding signals from those phases manifested more prominently. I direct your attention to Figure 12 below, elucidating the superconducting transition at a 29 mm distance.

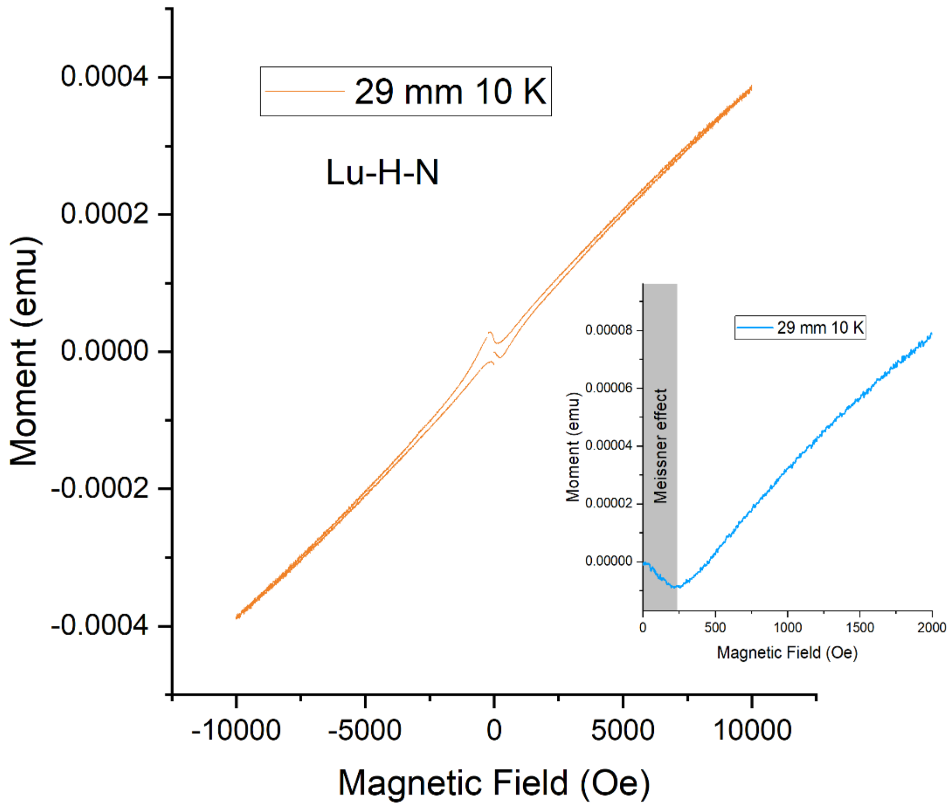

Figure 12: The MH curve of the SC Lu-H-N sample at 10 K. This is raw data without subject to any background removal. The inset shows the one part of the MH curve of the SC Lu-H-N sample at 10 K, identifying the different regions in the signal. The gray area represents the area that shows the true Meissner effect and one the applied field hits the Hc1 how it changed the direction.

The rationale behind selecting the 29 mm distance and utilizing the signal originating away from the sample as the background reflects the most effective approach for identifying the signal embedded within the background. This practice seamlessly aligns with established procedures in our field and draws parallels to infrared absorption studies conducted under pressure.

In the domain of IR absorptions, background subtraction is imperative for precisely identifying the correct peaks. A technique commonly employed in high-pressure research involves maintaining a constant pressure while varying the temperature to bring the sample to a different state, subsequently utilizing this as the background. This ensures consistency in the sample's thickness—

a critical factor in IR signal analysis. Analogously, our study adopted a similar approach. Dealing with a complex, multi-domain, multi-phase sample where one phase exhibited superconductivity, we aimed to eliminate the background originating from the non-superconducting portions of the sample. To achieve this, we gathered responses away from the sample itself and employed them as our background. This strategy closely approximates the true background under those specific conditions, resulting in more precise and reliable results.

e. Conclusion in Response to Accusation No. 6.

In conclusion, the data presented herein serves to debunk the claims made by the Investigation Committee regarding the M(H) data. The central argument revolves around the authenticity of the superconducting behavior observed in the Lu-H-N system. Addressing each claim individually, it is evident that the M(H) data was not fabricated, the sequestered data aligns with the published data, the published data was not derived from the sequestered data, and the M(H) curves were not fabricated.

However, critical discrepancies in the analyses conducted by Dr. Dissanayake have come to light, particularly in his identification of phases such as LuH8 and Lu2O3, leading to erroneous conclusions. This underscores the importance of rigorous scrutiny and transparency in scientific research, as evidenced by the need for additional analyses, such as Raman spectroscopy, to rectify these inaccuracies.

The accusations related to the PPMS VSM data are addressed by emphasizing the challenges posed by the heterogeneous nature of the samples. The interpretation differences between Dr. Dissanayake and the author highlight the inherent subjectivity in scientific interpretation, although it's crucial to distinguish this from data manipulation.

The significance of the Meissner effect in the M-H curve is underscored, providing strong empirical evidence for superconductivity in the Lu-H-N system. The arguments presented counter potential counterarguments related to critical temperature and sample heterogeneity. Furthermore, the transparency in presenting raw data without background subtraction reaffirms the credibility of the findings.

Despite interpretational differences, the author maintains the integrity of the data and the unequivocal evidence of superconductivity in the Lu-H-N system. This comprehensive response aims to provide clarity on the contested aspects of the investigation, emphasizing the importance of adherence to scientific rigor and transparency in addressing discrepancies.

* * *

7. Figure 1a, Tc(P) Data (Superconducting Critical Temperature as a Function of Pressure) Was Not Fabricated nor Falsified.

It is imperative to highlight the critical oversight by the Investigation Committee in failing to include all the R(T) data in its analysis. The Investigation Committee had unfettered access to and obtained complete copies of all my computers, files, and records. Consequently, every piece of

data collected in my lab was fully available for their scrutiny. The Investigation Committee, equipped with extensive resources, held meetings with students, research faculty, collaborators, and accessed information from editors, enjoying unrestricted access to all lab data. The assertion that I withheld data is unfounded, constituting a gross misrepresentation of the factual situation.

It is noteworthy that, to date, the Investigation Committee has not sought my assistance in locating specific data on the computers. Instead, reliance appears to have been placed on the reports of Ray McBride and Dylan Durkee, two graduate students with limited involvement in certain experiments and a misunderstanding of various aspects of the pressure measurements. Their reports to the Investigation Committee, undoubtedly influenced by their limited involvement and understanding, are incomplete and biased.

Regrettably, the Investigation Committee seems to have expedited their acceptance of this narrative without a diligent investigation into the true circumstances. The accusations, therefore, lack foundation and grossly distort the available evidence. This seems less of an oversight and more of a deliberate misrepresentation, revealing a clear manifestation of bias.

For the Investigation Committee to assert that they were not provided with my complete records is disingenuous and simply not reflective of the truth. If the Investigation Committee has been relying on students for information, their reliance has been misplaced. All the data points relevant to the Investigation Committee's accusation are housed in the files titled:

> " RM14_F1_10-4-21.opju; 11-2-21 redMatter gamma(elliot).opju; RMcryoruns_masterorigin_week_8-2-21.opju; redMatter_AF4_magnet-1..opju"

I was able to access these files, underscoring the accessibility and completeness of the records provided.

The Investigation Committee's assertion, stating that "external pressure can progressively modify the physical properties of a material and progressively enhance the interactions at the microscopic scale that are responsible for the emergence of superconductivity," unveils a notable gap in understanding the intricacies of the superconducting transition. While it is acknowledged that applying external pressure can indeed alter a material's physical properties, the pivotal aspect of pressure's influence lies in its capacity to induce structural modifications within the material.

It is widely acknowledged that superconductivity typically emerges following a structural phase transition induced by pressure. Such modifications can lead to a new phase or a change in crystal structure, creating conditions favorable to superconductivity. The resulting structural changes, prompted by pressure, play a crucial role in altering the density of electronic states near the Fermi level and modifying phonon modes, thereby facilitating electron pairing. It is crucial to emphasize that not all structural modifications under pressure will necessarily culminate in superconductivity. This clarification underscores the nuanced nature of the relationship between external pressure, structural changes, and the emergence of superconductivity, dispelling any oversimplifications in the Investigation Committee's initial statement.

a. Tc(P) Data (Superconducting Critical Temperature as a Function of Pressure) Was Not Fabricated nor Falsified.

The Investigation Committee's claim regarding the existence of 17 ρ vs Tc points derived from the resistance measurements in Figure 1a, followed by their acknowledgment of only 5 points, raises significant perplexity. I invite the Investigation Committee to review the figures presented below, which showcase all 17 data points. These data points are extracted from the information available in the file titled:

> "RM14_F1_10-4-21.opju; 11-2-21 redMatter gamma(elliot).opju; RMcryoruns_masterorigin_week_8-2-21.opju; redMatter_AF4_magnet-1..opju."

It is crucial to consider these comprehensive data files to ensure a thorough and accurate evaluation of the resistance measurements and associated ρ vs Tc points.

Equally noteworthy is the Investigation Committee's conclusion, characterizing the data as fabricated to illustrate a distinct trend of Tc (critical temperature) escalating below 10 kbar and diminishing above 10 kbar, with minimal scatter. This conclusion is not only baseless but also lacks merit. While I agree that observing the pressure dependence of Tc serves as compelling evidence for superconductivity, the Investigation Committee's assertion that I manipulated Tc vs. ρ data to depict this dependence is entirely unfounded. This is evident in the figures provided, encompassing all 17 data points. Furthermore, there are additional data points not featured in Figure 1a, further substantiating the pressure-dependent behavior of Tc.

It is essential to emphasize that all available data contradicts the Investigation Committee's assertions and challenges their misrepresentation of both the data and my research integrity. The comprehensive dataset, including the additional points, stands as a testament to the accuracy and legitimacy of the research findings, countering the Investigation Committee's unfounded allegations.

Furthermore, the Investigation Committee's reference to five specific data points is a limited representation. All five were derived from the same experiment. It is important to clarify that we recorded a total of six data points from that sample, not merely five (see below fig.1). The Investigation Committee, in examining these five data points, had direct access to the sixth data point located in the same folder, which was equally accessible. Remarkably, this sixth data point was included in one of the exhibits cited in the report, provided by student Dylan Durkee under the title "Red Matter Project." The Investigation Committee's utilization of figures from this report affirms their active access to and use of this information.

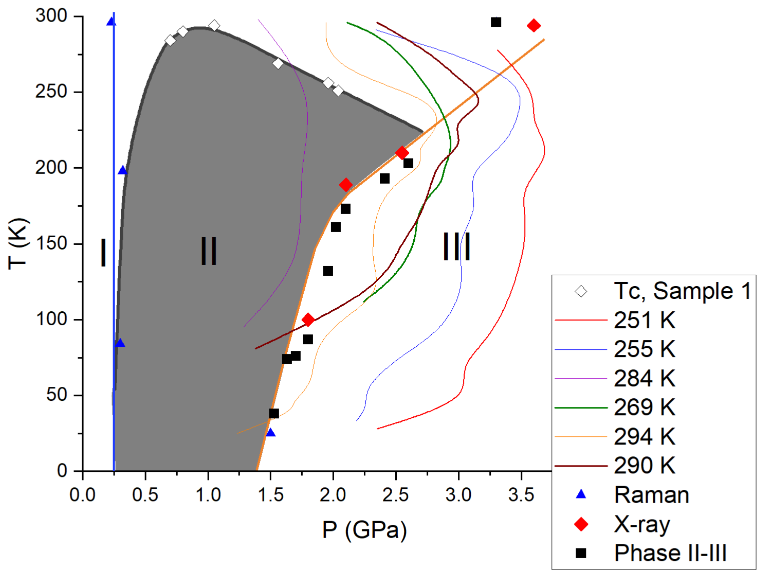

Figure 1. The superconducting dome of LuHN as a function of pressure. The colored curves represent the pressure changes during the cooling process for all six data points, where superconductivity was observed during the warm-up Generally, during the warm-up phase, a slight further decrease in pressure followed by a relatively constant pressure was observed.

However, an inexplicable oversight occurred, as the Investigation Committee failed to acknowledge the presence of the sixth data point detailed within that file. This omission is not a mere oversight; it constitutes a glaring lapse in their investigative process. The Investigation Committee's failure to recognize all the data points presented in a report they themselves cited raises serious questions about the thoroughness and impartiality of their analysis. This selective attention to the data undermines the credibility of their conclusions and implies a negligent, if not biased, approach to their investigation.

Setting aside the Investigation Committee's selective use of limited data points in the Dylan Durkee file, the comprehensive data presented in the figures below (data available to the Investigation Committee but ignored by them) unequivocally demonstrates a clear pressure dependence of the critical temperature (Tc). This behavior, with Tc initially increasing with pressure up to 10 kbar and subsequently decreasing until the sample undergoes a phase transition, strongly supports the occurrence of superconductivity.

To provide additional clarity, our methodical experimental progression at 10 kbar revealed superconductivity at 294 K. Subsequent pressure increases to 16 kbar resulted in a Tc of 269 K, while further elevation to 20 kbar showed superconductivity at 251 K. Beyond this point, the sample transitioned from phase II to III, marking the cessation of superconductivity. Upon decreasing the pressure, superconductivity was again detected – at 290 K at 8 kbar and 284 K at 7 kbar. This sequential data not only illustrates a consistent and comprehensible trend in the pressure dependence of Tc but also fundamentally contradicts the Investigation Committee's claims of data fabrication.

The methodical sequence of our experiments and the corresponding results underscore the authenticity and scientific validity of our findings. The Investigation Committee's failure to recognize this or its deliberate choice to ignore these facts raises serious questions about the integrity, objectivity, and reliability of the Investigation Committee's processes.

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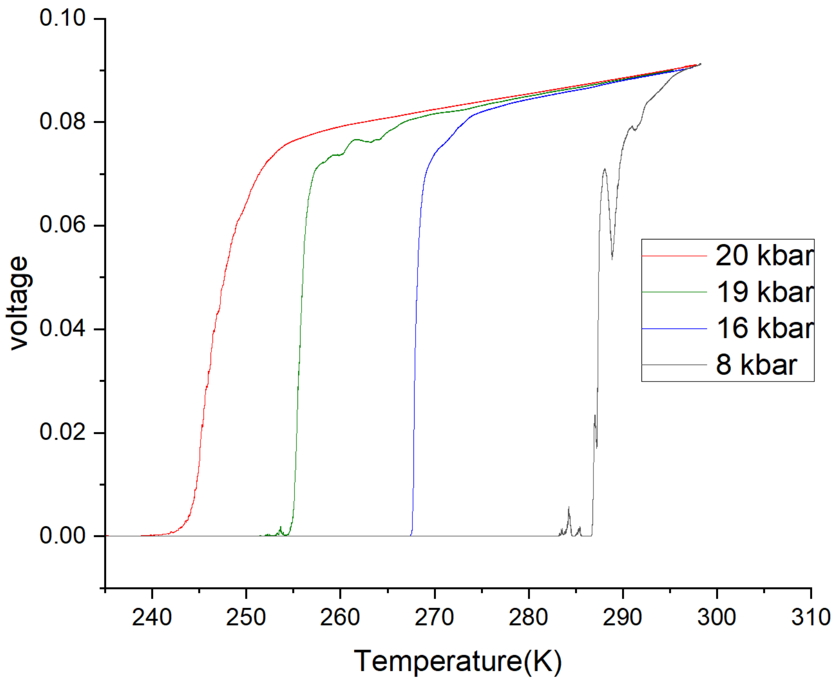
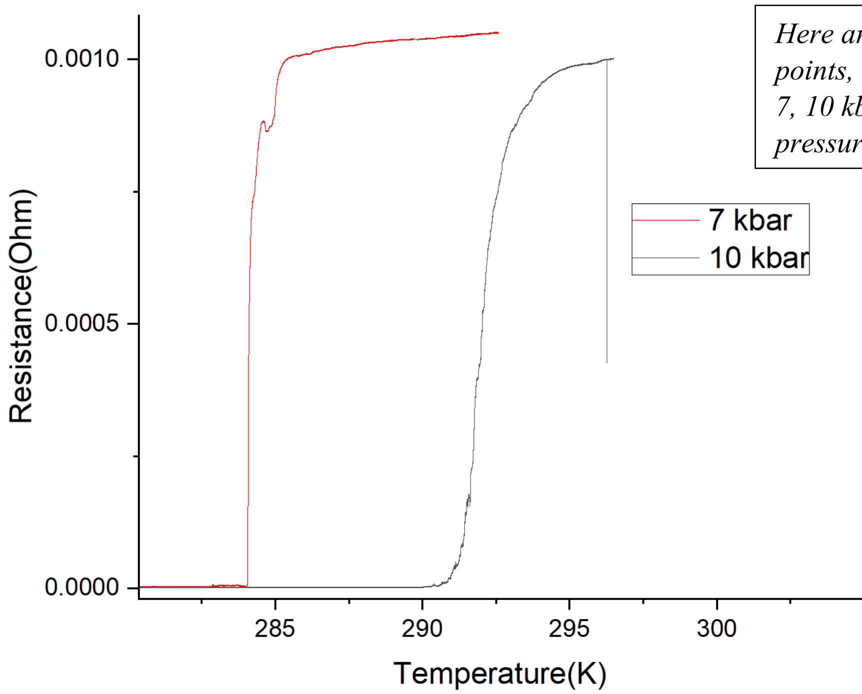
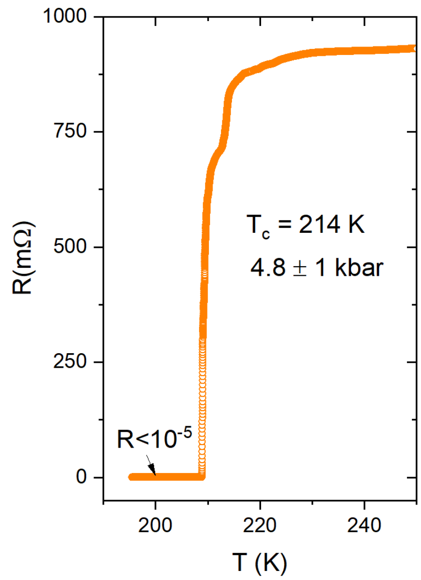
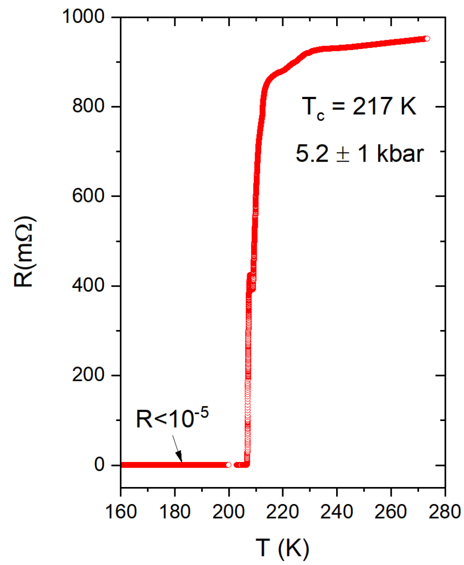


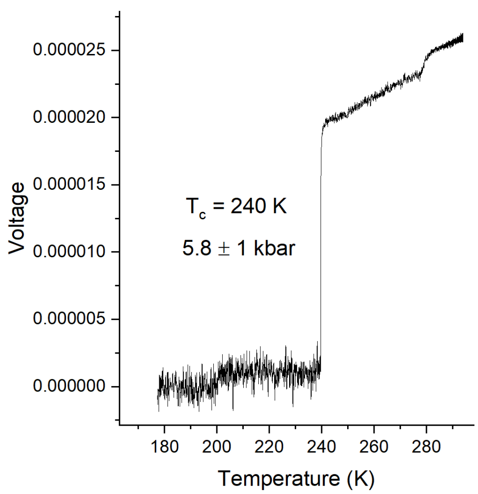
Here are 4 data points, reflecting, 8, 16, 19, 20 kbar pressure.

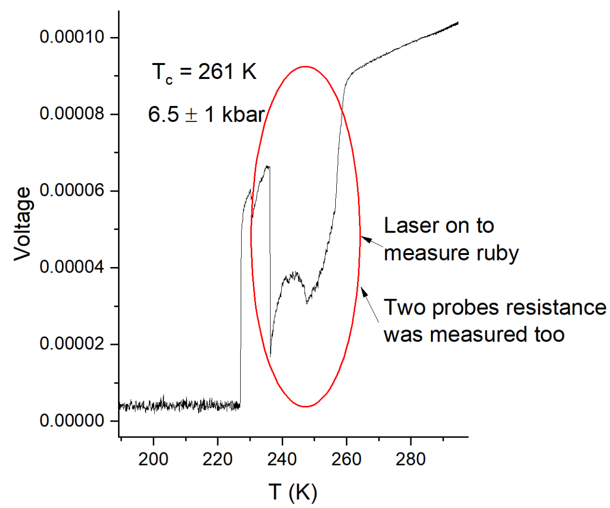


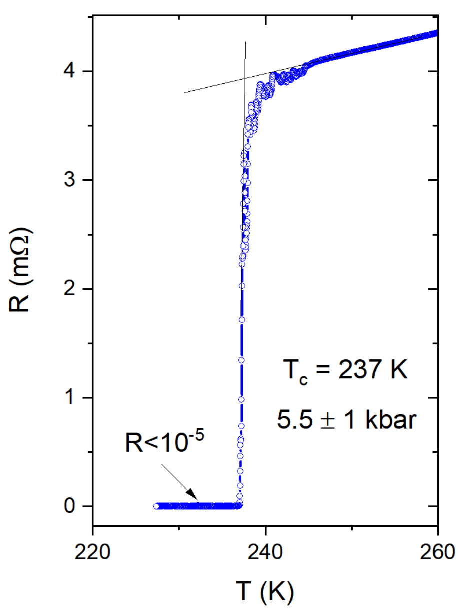
Here are 2 data points, reflecting, 7, 10 kbar pressure.

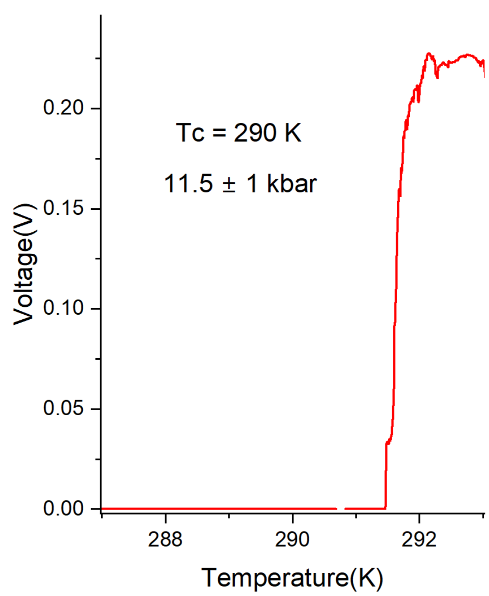

T_c = 214 K
4.8 ± 1 kbar
R<10^-5
R(mΩ)
T (K)

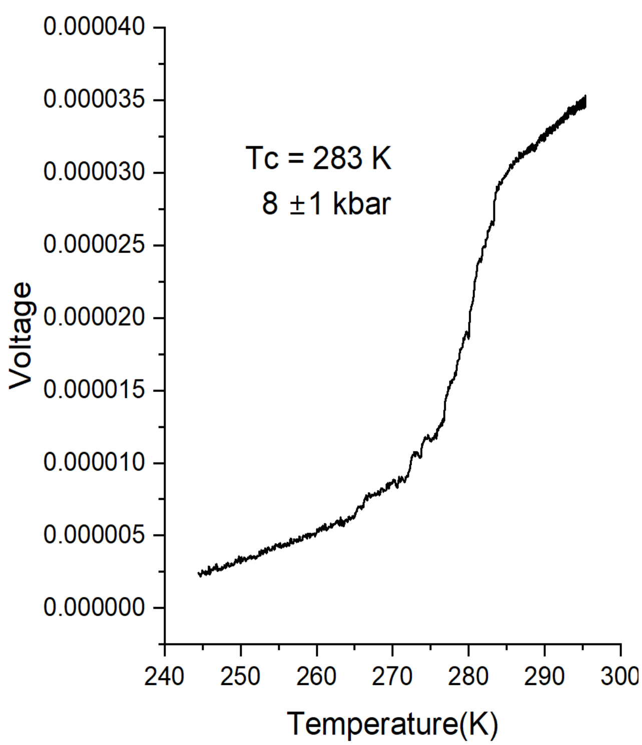

T_c = 217 K
5.2 ± 1 kbar
R<10^-5
R(mΩ)
T (K)

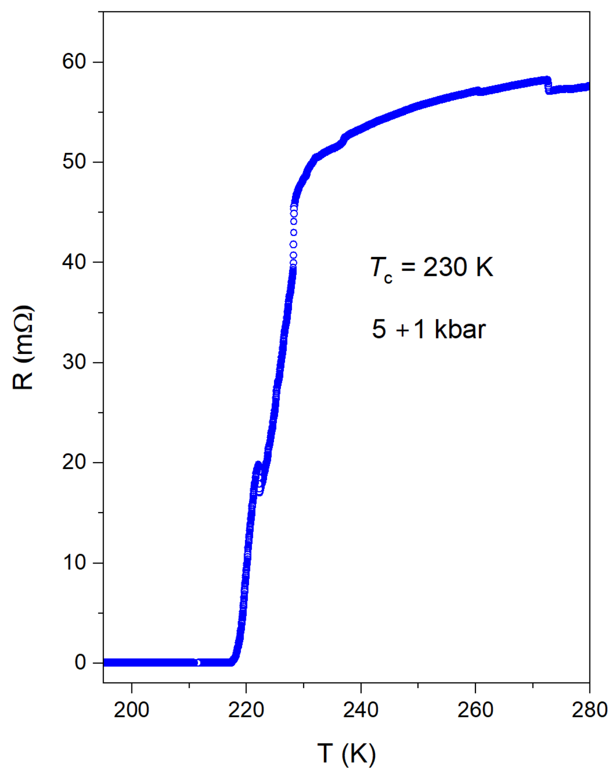

T_c = 240 K
5.8 ± 1 kbar
Voltage
Temperature (K)

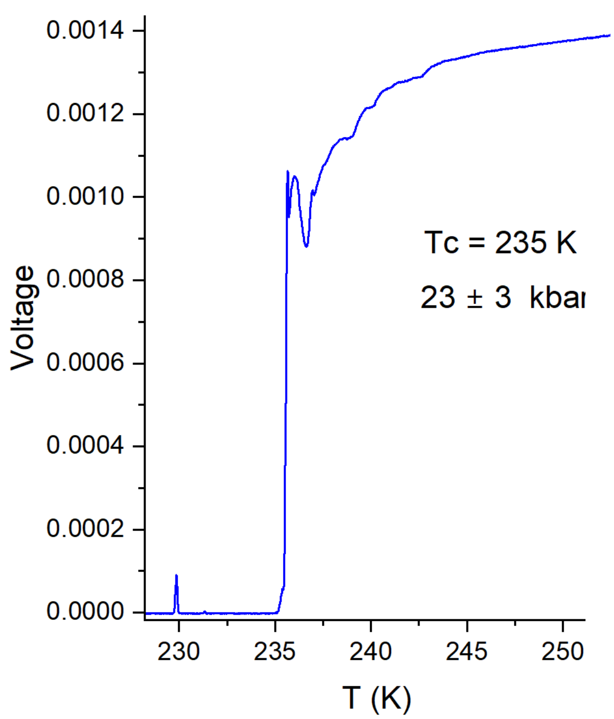

T_c = 261 K
6.5 ± 1 kbar
Laser on to
measure ruby
Two probes resistance
was measured too
Voltage
T (K)

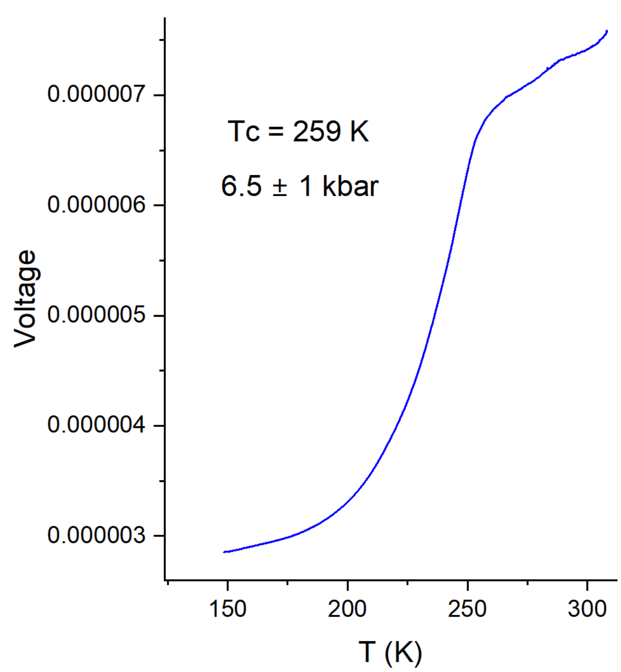

T_c = 237 K
5.5 ± 1 kbar
R<10^-5
R (mΩ)
T (K)

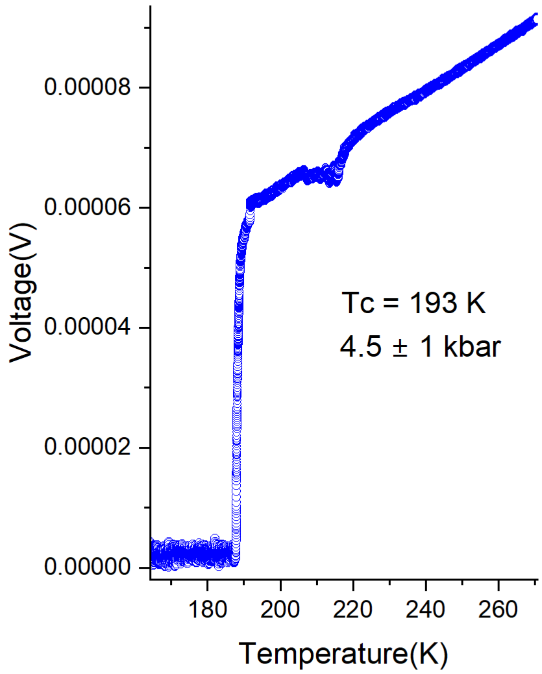

Tc = 290 K
11.5 ± 1 kbar
Voltage(V)
Temperature(K)


Tc = 283 K
8 ±1 kbar
Voltage
Temperature(K)
0.000040
0.000035
0.000030
0.000025
0.000020
0.000015
0.000010
0.000005
0.000000
240 250 260 270 280 290 300

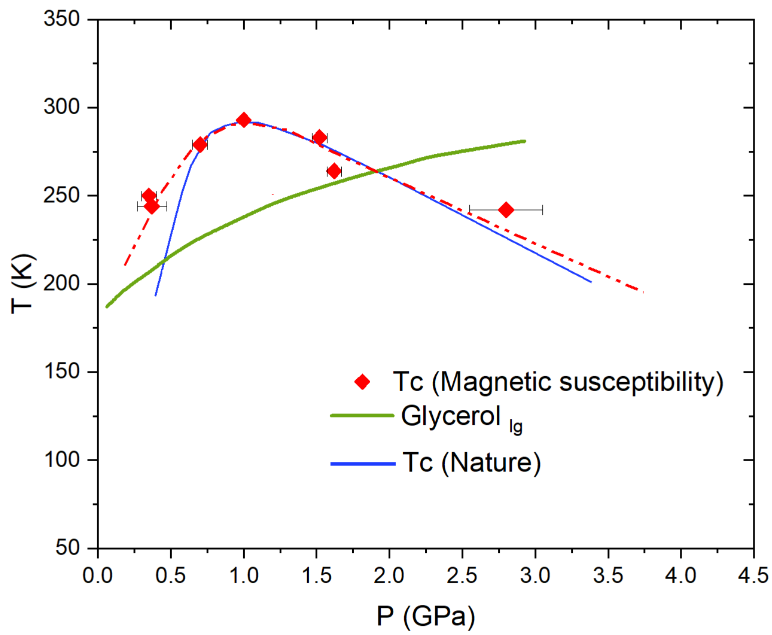

T_c = 230 K
5 +1 kbar
R (mΩ)
T (K)
60
50
40
30
20
10
0
200 220 240 260 280


Tc = 235 K
23 ± 3 kbar
Voltage
T (K)
0.0014
0.0012
0.0010
0.0008
0.0006
0.0004
0.0002
0.0000
230 235 240 245 250


Tc = 259 K
6.5 ± 1 kbar
Voltage
T (K)
0.000007
0.000006
0.000005
0.000004
0.000003
150 200 250 300


Voltage(V)
0.00008
0.00006
0.00004
0.00002
0.00000
Tc = 193 K
4.5 ± 1 kbar
180
200
220
240
260
Temperature(K)

In our recent investigation, we consistently observed a pressure-dependent trend in the critical temperature (Tc) through magnetic susceptibility measurements, mirroring our earlier studies. This coherence across diverse measuring techniques and distinct samples serves to fortify the robustness and reliability of our research outcomes. The figure provided below visually encapsulates this correlation: the blue solid line corresponds to the data published in the Nature paper, while the red diamond data points signify our recent magnetic susceptibility measurements. Notably, the new Tc vs. P data exhibits a remarkable alignment with the data from the Nature paper. This internal consistency across methodologies underscores the legitimacy of our findings and challenges any suggestion of data manipulation.



Pressure dependence of the transition temperature based on magnetic susceptibility studies. The green solid line is the glycerol condensation phase line.

Additionally, another research team, led by Rus Hemley and focused on the same material, performed resistance measurements under pressure. Notably, their data exhibits a strong correspondence with the phase diagram we published in Nature. The alignment between our findings and those of a separate group, employing distinct instruments and setups in their laboratory, introduces a level of improbability to the notion of fabricated data. The consistent agreement across independent studies transcends mere coincidence, emphasizing the reproducibility and reliability of the observed phenomena. This alignment challenges any assertions of data fabrication, further bolstering the credibility of our research. See below figure from their pre-print.

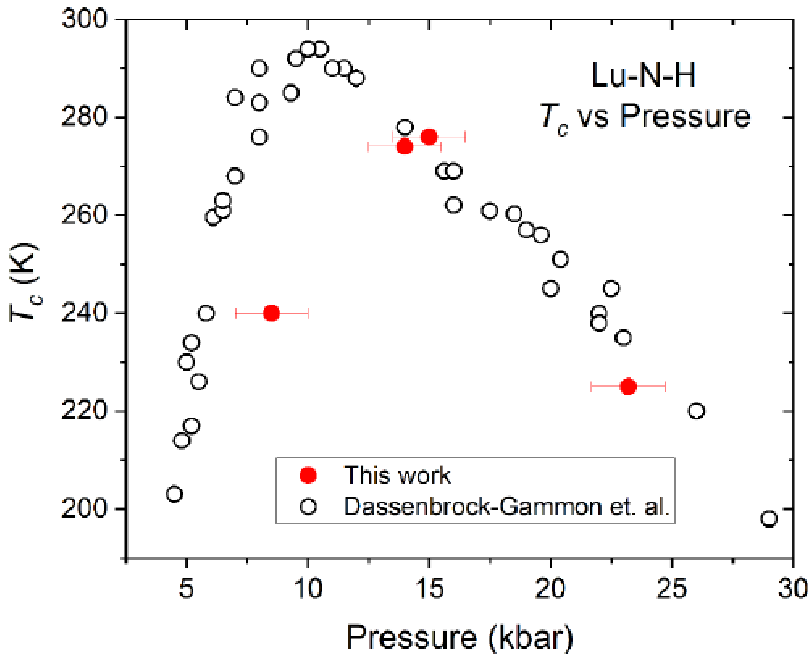


Figure 2. *Pressure dependence of T_c in the Lu-N-H system from this work (red) and reported by Dasenbrock-Gammon et al.*[7]

Figure 2. above is from replication by Russell Hemley's Group.

Lastly, it is crucial to highlight that the data presented in the Nature paper's Extended Data Figures 13 and 15, while reinforcing our conclusions regarding pressure dependence, were not employed to support the assertions made in Figure 1a.

This comprehensive response to the Investigation Committee's accusations has shed light on critical aspects of our research integrity and the validity of our findings. The thorough examination of data points, their accessibility, and the alignment across different measuring techniques and independent research groups, as demonstrated by Rus Hemley's team, collectively underscore the credibility and robustness of our work. The consistent pressure-dependent trends observed through various methods and the reproducibility of our results challenge any insinuations of data fabrication. The apparent oversights, selective attention to data, and misinterpretations within the Investigation Committee's investigation process raise questions about the objectivity and thoroughness of their analysis.

b. The Tc(P) Data Near 270K Was Not Fabricated.

This claim by the Investigation Committee is duplicative of the Investigation Committee's Accusation No. 5 discussed above. Professor Dias incorporates by reference his complete response above as though fully set forth herein.

c. The Tc(P) Data Near 20kbar and 245K Was Not Fabricated.

This claim by the Investigation Committee is duplicative of the Investigation Committee's Accusation No. 4 discussed above. Professor Dias incorporates by reference his complete response above as though fully set forth herein.

d. Conclusion in Response to Accusation No. 7

In reflecting on the Investigation Committee's examination of Figure 1a, which pertains to the Tc(P) data (Superconducting Critical Temperature as a Function of Pressure), it is crucial to address the critical oversight in their failure to include all the R(T) data in their analysis. Despite having unfettered access to and obtaining complete copies of all the computers, files, and records in my lab, the Investigation Committee's assertion that I withheld data is baseless and misrepresents the factual situation.

It is worth noting that the Investigation Committee did not seek my assistance in locating specific data on the computers, and their reliance on the reports of graduate students Ray McBride and Dylan Durkee, who had limited involvement and understanding, resulted in incomplete and biased information. The Investigation Committee's expedited acceptance of this narrative without a diligent investigation into the true circumstances suggests a deliberate misrepresentation and reveals a clear manifestation of bias.

The Investigation Committee's claim that they were not provided with my complete records is disingenuous, as all relevant data points are housed in the files titled "RM14_F1_10-4-21.opju; 11-2-21 redMatter gamma(elliot).opju; RMcryoruns_masterorigin_week_8-2-21.opju; redMatter_AF4_magnet-1..opju." The comprehensive dataset, including additional points, contradicts the Investigation Committee's baseless allegations, standing as a testament to the accuracy and legitimacy of the research findings.

Furthermore, the Investigation Committee's characterization of the Tc vs. ρ data as fabricated to illustrate a specific trend lacks merit. The figures provided encompass all 17 data points, and the additional data points not featured in Figure 1a further substantiate the pressure-dependent behavior of Tc. The Investigation Committee's failure to acknowledge all relevant data points, especially the sixth data point in the same folder, raises questions about the thoroughness and impartiality of their analysis.

The Investigation Committee's selective use of limited data points and their failure to recognize all the data points presented in a report they cited undermines the credibility of their conclusions. The comprehensive data unequivocally demonstrates a clear pressure dependence of the critical temperature (Tc), contradicting the Investigation Committee's claims of data fabrication.

In conclusion, the apparent oversights, selective attention to data, and misinterpretations within the Investigation Committee's processes raise questions about the objectivity and thoroughness of their analysis. The consistent pressure-dependent trends observed through various methods and

the reproducibility of results challenge any insinuations of data fabrication, underscoring the credibility and robustness of the research.

* * *

8. Overall Conclusion in Response to the Investigation Committee's Incorrect Accusations in the Draft Report D. Nature 2023 (LuH) Paper

It is essential to highlight the Investigation Committee's apparent lack of expertise in high-pressure, low-temperature superconductivity research. The intricate nature of the experiments conducted in the study involves specialized knowledge and familiarity with the experimental equipment and procedures unique to this field. The Committee's limited experience in this specific domain raises questions about its capacity to accurately assess the nuances of the research under scrutiny. Additionally, the Committee's potential bias, stemming from its different background and orientation towards shock physics, introduces a notable divergence in perspectives. This divergence may lead to a misunderstanding of the complexities inherent in high-pressure low-temperature superconductivity research, potentially contributing to the misinterpretation of data and findings. Acknowledging the disparities in expertise and orientation is crucial in assessing the Committee's ability to fairly evaluate the validity of the scientific work in question.

In conclusion, the comprehensive response provided to the Investigation Committee effectively refutes the inaccuracies and misinterpretations in Draft Report D. Nature 2023 (LuH) Paper. The meticulous analysis of each accusation concerning Figure 2a, Figure 13a, Extended Data Figure 15, Figure 4, Figure 3a, Figure 3b, and Figure 1a demonstrates that the data presented in the paper was neither falsified nor fabricated. The detailed explanations regarding temperature ranges, data manipulation, and the correctness of various curves and coefficients contribute to a clear and thorough defense against the accusations. This response serves as a robust and evidence-based defense of the scientific integrity of the research conducted, addressing each accusation with transparency and rigor.

* * *

9. Subsequent Published Independent Work Confirms Findings

In addition to the aforementioned responses, we note that Prof. Rus Hemley's group has observed similar behavior and has interpreted the data as evidence of a superconducting transition, as indicated in their publication (https://arxiv.org/abs/2306.06301). This further supports the validity of our findings.

* * *

10. Unearthly Materials, Inc.'s Advanced Research

Unearthly Materials, Inc. is at the forefront of groundbreaking research, delving into the intricacies of high-temperature superconductors. Our latest exploration, detailed in the Nature paper, focuses on unraveling the stoichiometries of Nitrogen-Doped Lutetium Hydrides (Lu-N-H). Despite the unknown composition of hydrogen and nitrogen atoms, our comprehensive study combines

advanced synthesis and characterization methods, X-ray diffraction, Raman spectroscopy, and Density Functional Theory calculations to understand the superconducting stoichiometry, shedding light on the superconducting state of the Lu-N-H system. Through meticulous investigation, we have identified LuH2.2N0.72 as a stable compound, exhibiting superconductivity at an impressive 205 K under 10 kbar. By incorporating slight variations in vacancies and pressure, we posit that the transition temperature has the potential to surpass 250 K. It is noteworthy that most theoretical calculations and experimental efforts have predominantly focused on materials with minimal nitrogen content, a condition not conducive to high Tc superconductivity. Nitrogen emerges as a pivotal factor in both stabilizing the material and augmenting the electron density at the Fermi level. The methodology employed, involving controlled annealing cycles, precise reagent ratios, elemental analysis, EDAX, and magnetic susceptibility measurements, demonstrates the potential of achieving high-Tc superconductivity. Our findings not only offer valuable insights into the electronic and dynamical properties of LuH2+xNy but also exhibit a compelling internal consistency across diverse measurement techniques, reaffirming the robustness and reliability of our research outcomes.

a. Unraveling High-Tc Stoichiometries in Nitrogen-Doped Lutetium Hydrides.

In the 2023 (LuH) Nature paper that is the subject of the investigation, despite the unknown composition and stoichiometry of hydrogen (H) and nitrogen (N) atoms, our investigation, utilizing advanced synthesis and characterization methods, X-ray diffraction, Raman spectroscopy, and Density Functional Theory (DFT) calculation, points to a probable high Tc superconducting stoichiometry. This is composed by a combination of N substitutions and H-vacancy defects, forming the sequence L-N-H.

Our in-depth analysis delves into the impact of Ho (octahedral position) content (x(Ho)) on the electronic and dynamical properties of LuH2+x, as well as the influence of nitrogen incorporation of N atoms on the octahedral vacancies. This extends to examining the nitrogen content (y(N)) in LuH2+xNy. Our findings reveal that, for specific x(Ho) and yo(N) values, achieving high-Tc is feasible. This not only provides crucial insights into the superconducting state of the Lu-N-H system but also emphasizes the significance of controlling these parameters.

Following an exhaustive study, we have identified LuH2.2N0.72 as a stable compound, as illustrated in Fig.1. Moreover, this compound exhibits superconductivity at an impressive 205 K under 10 kbar. The implication is that stoichiometries with y(N) values approximately around 0.72 may be present in samples showing evidence of room-temperature superconductivity.

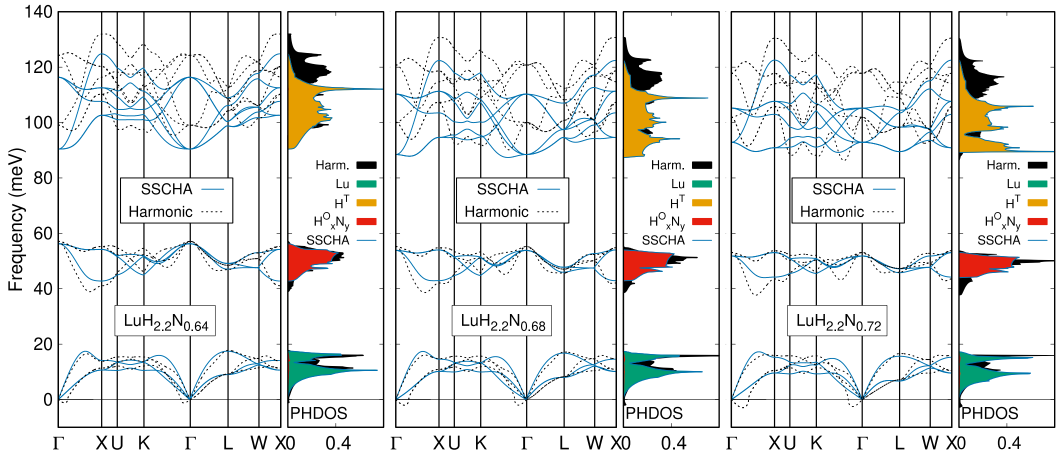


Fig.1. Phonon dispersion, total and projected phonon density of states calculated for LuH2.2N0.64 (a), LuH2.2N0.68 (b), and LuH2.2N0.72 (c) at 1 GPa. Solid and dashed lines represent the SSCHA and harmonic DFPT calculations, respectively.

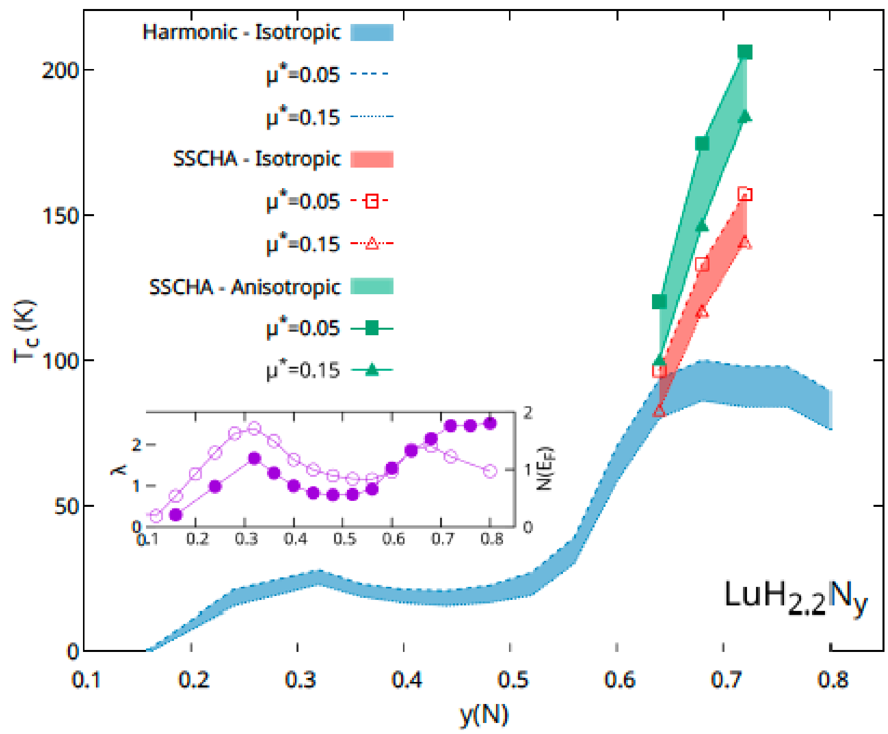


Fig.2. Superconducting critical temperature (Tc) as a function of Nitrogen doping contend (y(N)) for LuH2.2Nx at 1 GPa. It shows Tc calculated from the isotropic (dashed lines) and anisotropic (solid lines) ME equations. The inset shows with filled circles the electron-phonon parameter (λ) and the density of states at EF (N (EF)) with open circles within the harmonic approximation as a function of y(N).

b. Evidence of the Specific Stoichiometry That Is Superconducting at High Temperatures.

Indications of the specific stoichiometry conducive to high-temperature superconductivity emerge from our experimental process. While a rigorous final analysis is pending, the outcomes from the synthesis of targeted hydrides and nitrides suggest evidence of the correct phase, as discerned from the Raman spectra (refer to Fig. 3). The procedural steps involved requisite reagents to generate hydride and nitride, followed by heating the sample to 600°C. This facilitated the reaction of lutetium, resulting in the formation of lutetium hydride. Subsequently, the ampoule was heated to 1100°C to initiate the nitrogen reaction, forming a LuN sample with hydrogen gas in the ampoule. Lowering the temperature back to approximately 600°C or lower allowed hydrogen to react with the LuN sample. The process employed multiple cycles of heating and cooling to anneal the sample, ensuring the re-implantation of hydrogen into LuN. Precise control of the Lu:H:N ratio through reagent masses facilitated accurate nitrogen doping of the hydride lattice. Full details of the synthesis process can be reviewed in Appendix II hereto.

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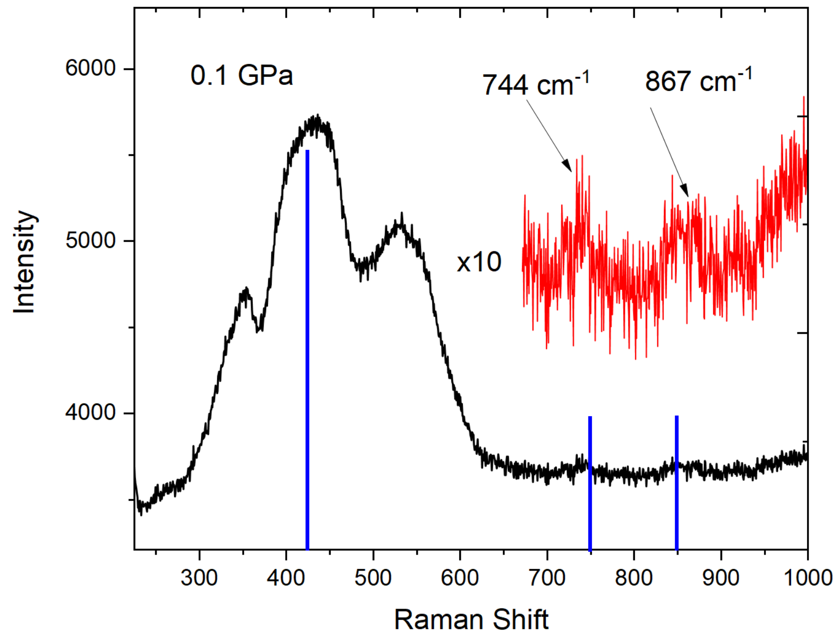


Fig.3. Raman spectra of the superconducting phase in the Lu-H-N system are shown. The red spectrum represents a magnified version, approximately 10 times, of the range from ~700 cm-1 to 1000 cm-1. The primary feature is observed around 420 cm-1, while the other two peaks at approximately 350 cm-1 and 550 cm-1 vary due to differences in nitrogen content. The blue lines depict the frequencies obtained from the calculated Raman spectra of LuH2.2N0.72.

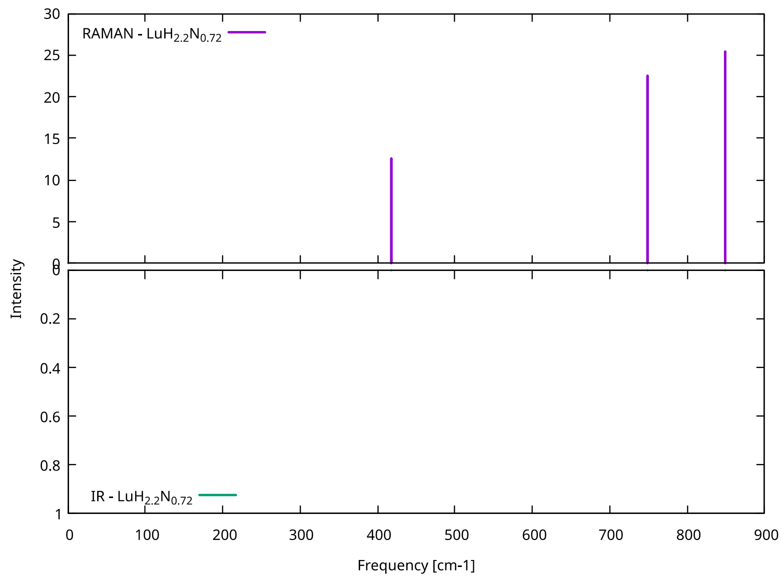
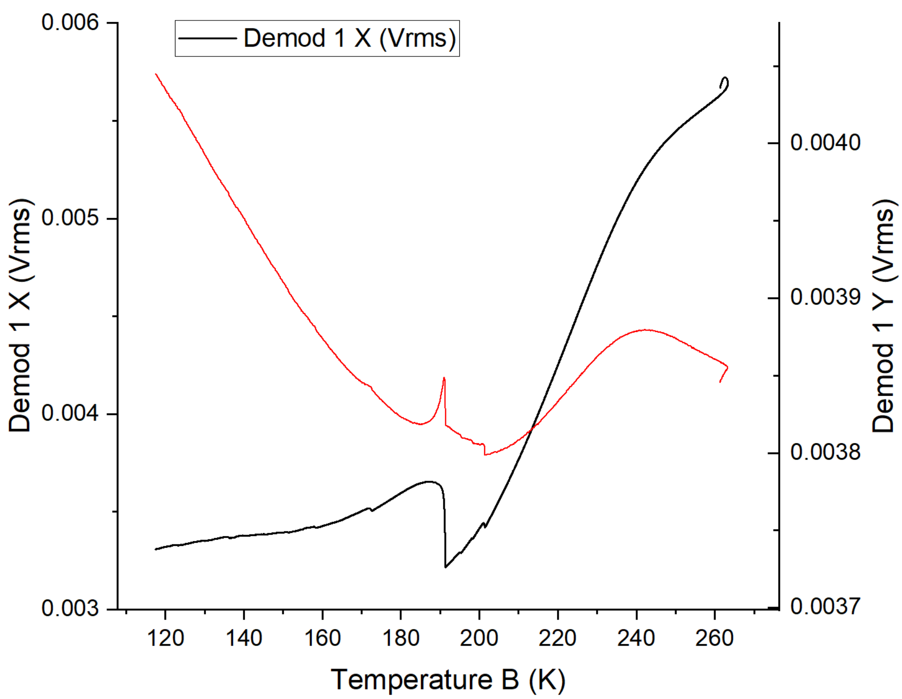


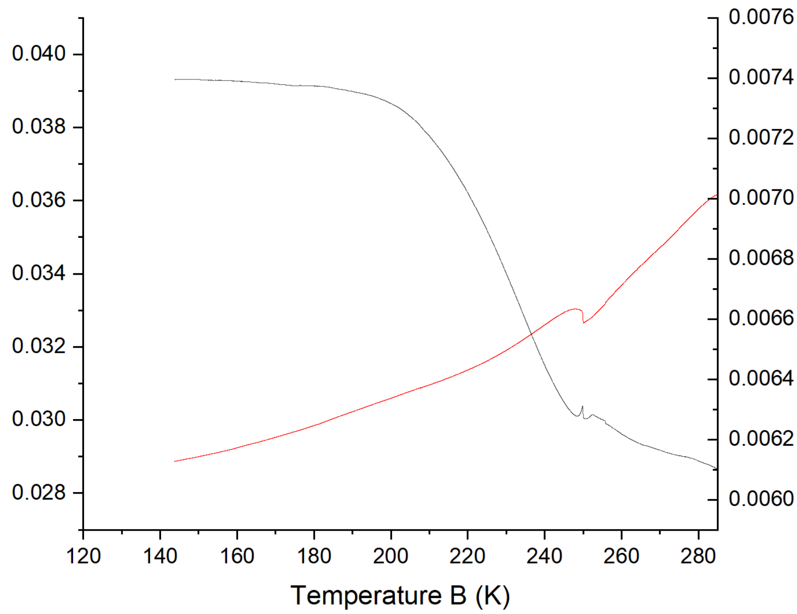
Fig. 4. Calculated Raman spectra of LuH2.2N0.72. The height of the purple lined does not represent the intensity of the peak.

c. Magnetic Susceptibility Measurements of Close to Above Stochiometric LuHN System.

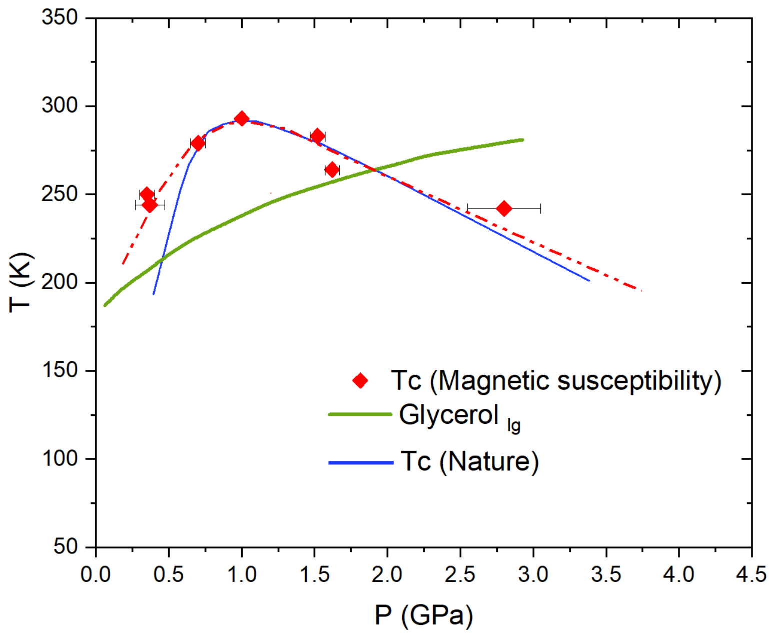


Under ambient conditions of approximately ~ 5 kbar pressures, the A.C. susceptibility analysis reveals pronounced diamagnetic shielding during the superconducting transition at 190 K. The depicted data showcases the real part in black and the imaginary part in red. Additionally, the

accompanying figure illustrates the manifestation of superconductivity at around 250 K under increased pressure, specifically at 16 kbar.



In our recent investigations, a consistent and pressure-dependent trend in the critical temperature (Tc) has been discerned through magnetic susceptibility measurements, aligning with our earlier studies. This coherence, observed across diverse measurement techniques and distinct samples, reinforces the robustness and reliability of our research outcomes. The accompanying figure visually illustrates this correlation, with the blue solid line representing the data published in the Nature paper, and the red diamond data points denoting our recent magnetic susceptibility measurements. Notably, the new Tc vs. P data demonstrates a remarkable alignment with the findings from the Nature paper. This internal consistency across methodologies not only underscores the legitimacy of our conclusions but also refutes any insinuation of data manipulation.



Pressure dependence of the transition temperature based on magnetic susceptibility studies. The green solid line is the glycerol condensation phase line.

d. Conclusion

In conclusion, Unearthly Materials, Inc. has embarked on a pioneering exploration into high-temperature superconductors, with a specific focus on Nitrogen-Doped Lutetium Hydrides (Lu-N-H). Our research, detailed in the 2023 (LuH) Nature paper and subsequent investigations, has significantly advanced our understanding of the superconducting state of the Lu-N-H system.

The identification of a probable crystal structure, Fm3m, characterized by N substitutions and H-vacancy defects, underscores our commitment to unraveling complex stoichiometries. The depth of our analysis, particularly examining the impact of Ho content (x(Ho)) and nitrogen incorporation (y(N)), has revealed specific conditions conducive to achieving high-Tc superconductivity.

Our findings culminate in the identification of LuH2.2N0.72 as a stable compound exhibiting superconductivity at an impressive 205 K under 10 kbar. This not only provides evidence of the specific stoichiometry that supports room-temperature superconductivity but also emphasizes the importance of meticulous control over parameters such as x(Ho) and y(N).

The experimental synthesis of targeted hydrides and nitrides, while pending rigorous final analysis, offers compelling evidence of the correct phase, as indicated by Raman spectra. The precise control over the Lu:H:N ratio through reagent masses has enabled accurate nitrogen doping of the hydride lattice, further enhancing our understanding of the superconducting behavior.

Furthermore, magnetic susceptibility measurements under varied conditions consistently demonstrate a pressure-dependent trend in the critical temperature (Tc). The alignment of these results across diverse measurement techniques and distinct samples attests to the robustness and reliability of our research outcomes. The coherence observed between our recent Tc vs. P data and

the Nature paper findings reinforces the internal consistency across methodologies, firmly establishing the legitimacy of our conclusions and dispelling any notion of data manipulation.

In summary, our comprehensive investigations not only contribute valuable insights into high-temperature superconductors but also exemplify my commitment to advancing scientific knowledge in this cutting-edge field.

B. Draft Report C. Chemm Commun. 2022 Paper

I will thoughtfully and respectfully address the various concerns raised, which seem to share some perspectives with those articulated by Dr. Hirsch and Dr. Hamlin. It is observed that the approach taken by the Investigation Committee may bear certain resemblances to these individuals, displaying traits that could sometimes be seen in the realm of conspiracy theories. These traits include confirmation bias, which involves seeking information that aligns with pre-existing beliefs, a tendency to perceive patterns and connections where they might not exist, and selective skepticism, characterized by a detailed examination of official accounts while more readily considering alternative explanations that may not have been as thoroughly verified.

It is crucial to underscore that there seems to be a perceived absence of a robust logical foundation in the Investigation Committee's hypothesis that the data might have been fabricated. Such assertions appear to stem from suppositions, the identification of what are perceived as patterns, or the belief that certain observations seem unusual. These methodologies do not seem to fully align with the rigorous scientific standards that are generally expected to substantiate claims of data fabrication or falsification.

1. The Investigation Committee's Complete Access to Data

I deeply appreciate the concern raised by the Investigation Committee regarding the availability of raw data files for the measurements in question. I would like to respectfully clarify that the Committee had full access to all my laboratory resources. These resources include laboratory notebooks, laboratory equipment, laboratory and office computers, data files, and records.

The decision to provide complete access to these resources was motivated by a commitment to ensuring transparency and cooperation with the investigation process. It's important to recognize that the absence of certain raw data files does not inherently indicate their non-existence or suggest any misconduct on my part. This situation may arise from the data management practices I employ in my research. I have endeavored to maintain appropriate laboratory notebooks and records, which act as the primary documentation for all experiments conducted.

In addition, the laboratory computers and data files were made fully accessible to the Investigation Committee. This was done to facilitate their ability to verify and cross-reference the data used in my research. These resources house extensive data pertinent to my experiments, offering ample material for analysis to evaluate the validity of my findings. I wish to emphasize my willingness to provide access to these resources as a demonstration of my dedication to transparency and in addressing any queries regarding the integrity of my work. I remain confident that a thorough,

independent, and unbiased examination of the available documentation and records will affirm the legitimacy of my scientific contributions and the credibility of my work.

* * *

2. Anomalies in Data Management Do Not Equate to Scientific Misconduct

I sincerely appreciate the examination conducted by the Investigation Committee into the characteristics of the datasets provided. I would like to respectfully suggest that the discrepancies and anomalies observed in the datasets be interpreted with caution and not immediately interpreted as evidence of scientific misconduct. The points raised by the Investigation Committee are addressed as follows:

Timestamps and Data Collection: I acknowledge the Committee's observation regarding the absence of timestamps in the provided data, which makes it challenging to discern if data were collected during cool-down or warm-up phases. In my laboratory, it is standard practice to not record or use cool-down measurements as they may not accurately represent the material's true behavior, as I have previously communicated. The lack of timestamps, while noted, does not inherently imply any wrongdoing, as there are legitimate reasons for such data management practices.

Data File Sizes: The variation in data file sizes observed by the Committee can be attributed to specific experimental conditions, variations in measurement parameters, or the nature of the experiments themselves. Smaller file sizes should not be automatically equated with data manipulation or fabrication. I have included a few other examples where the data size ranges from approximately 2,000 to 150,000 data points within a similar temperature range.

Truncation of Datasets: The truncation of datasets near 100 K, as noted in the provided data, has multifaceted reasons. This includes focusing on specific temperature ranges of interest in superconductivity research, which may differ from the broader perspective typically held by shock physicists like the Committee members. Such truncation should not be hastily considered as evidence of misconduct.

Differences in Slope and Curvature: Variations in the slope and curvature of datasets, especially near room temperature compared to cool-down experiments, can be due to differences in experimental conditions and parameters. It is not uncommon for datasets to exhibit variations under different conditions, and this should not be automatically seen as misconduct.

Temperature Differences: The temperature differences observed in the datasets may be explained by factors such as data acquisition methods, measurement techniques, and equipment settings. It is important to recognize that the behavior of high-pressure materials, particularly those exhibiting superconductivity, can deviate from standard digitization expectations.

Anomalies in Temperature Series: While anomalies in the temperature series warrant thorough investigation, they may also result from factors like instrument settings, specific measurement

setups, and experimental conditions. It is vital to consider alternative explanations before drawing conclusions.

In summary, although the Investigation Committee has identified certain features in the datasets, it is crucial to approach these observations with scientific rigor and an open mind. The presence of anomalies should encourage further investigation and scrutiny, but they should not be automatically deemed evidence of scientific misconduct. It's important to understand that scientific research often involves complexities and nuances that can result in variations in experimental data. I am fully committed to addressing any concerns and cooperating with the Investigation Committee to ensure a comprehensive and fair evaluation of my research. I firmly believe that a closer examination of the scientific aspects, rather than speculation and conjecture, will lead to a more accurate understanding of the validity of my work.

* * *

3. Collaborative Work with Ashkan Salamat Was a Mistake but It Is Not Scientific Misconduct

During my scientific endeavors, I encountered a situation involving Ashkan Salamat, during which he reached out to me with a request that I advance scientific credit to him based on my work. This request was driven by Ashkan Salamat's personal frustration, stemming from his perception that his contributions to the field of superconductivity were not receiving the recognition he believed he deserved. He expressed concerns that the scientific community might have regarded him as a mere presence for appearances rather than recognizing any substantive scientific contributions, a sentiment he openly conveyed.

Regrettably, I found myself in a situation where external pressures influenced my actions. Ashkan Salamat's request was made with the intention of ensuring that his contributions were acknowledged and credited within the scientific community. It is essential to acknowledge that my compliance with this request was driven by the desire to support my colleague's legitimate concerns and aspirations for proper recognition of his work. I deeply regret acquiescing to Askan Salamat’s request which he has now weaponized against me.

* * *

4. The Investigation Committee’s Flawed Conclusion that CSH Has Not Been Replicated

I would like to respectfully address the assertion made by the Investigation Committee regarding the replication of my work on carbonaceous sulfur hydride (CSH). I believe it is important to provide context to this claim. The research on CSH has been ongoing for a relatively brief period of three years, and the Lu-H-N research has been in progress for just ten months. Reflecting on the history of high-pressure, high-temperature superconductivity research can be insightful. For example, the groundbreaking work by Eremets on H2S, published in 2014, took seven years before independent replication occurred in 2022. Despite the sample being commercially available, other researchers faced substantial challenges in replicating the results. My own attempts to replicate

this work, failing to observe superconductivity at 203 K, do not imply that his findings were fabricated. I hold a high regard for his H3S work. The challenges faced by those attempting replication, unable to use the same method as Eremets et al., highlight the complexities of these experiments. Notably, LaH10 is the only material that experienced concurrent successful replication by two separate groups, underscoring the intricacy of these experiments. In the case of CSH, achieving the desired outcome requires precise control over the proportions of the three constituent species and their reaction pathways. The variability in the superconducting phase due to carbon content was discussed in a theoretical paper by Ge et al., titled "Hole-Doped Room-Temperature Superconductivity in H3S1-xZx" (*Materials Today Physics 15, (2020)*).

Additionally, with all due respect, I wish to note that many papers authored by the chair of the Investigation Committee, including the notable work by Millot et al. on "Experimental Evidence for Superionic Water Ice Using Shock Compression" (Nature Physics 14, 297-302, 2018), have not been replicated either. Therefore, suggesting that a lack of replication automatically implies data fabrication or falsification does not seem to be a sound basis for such allegations. If the standards of the Investigation Committee were universally applied, many papers in the high-pressure research field that remain unreplicated could be viewed as potentially based on fabricated or falsified data.

My involvement in superconductivity under pressure has been a passionate endeavor since 2008, beginning when I joined Professor Choong-Shik Yoo's respected research group. Initially, my research focused on carbon and sulfur mixtures, starting with CS2 (Carbon disulfide). This naturally led to studying H2S in 2009, six years before Eremets' notable work. My research at that time reached up to 110 GPa, during which I observed the decomposition of H2S and the onset of sulfur's superconductivity. Had my experiments extended beyond 110 GPa, I believe I might have discovered the superconductivity of H3S.

The incorporation of carbon into the H2S system, culminating in the discovery of CSH, stemmed from my intuition and insight. My research journey placed me on a path of exploration ahead of many others, where I recognized the importance of a ternary system with covalent bonds as key to achieving our research objectives, a realization that came to me before it became a widespread research focus.

In the context of MgB2, achieving success requires the presence of strongly covalent-bonding/antibonding states intersecting the Fermi energy. However, covalent metals are scarce under ambient conditions. Hydrogen-rich compounds (hydrides) at high pressures, characterized by an excess of hydrogen, provide a solution. Impurities within the hydrogen matrix act as a chemical pressure, reducing the required pressure for metallization.

It is also important to consider that the lack of optimal electronegativity among non-hydrogen atoms can hinder the formation of covalent metals, limiting the potential for high Tc superconductivity. Elements with strong electronegativity tendencies often result in insulating hydrides, while those with weaker electronegativity produce hydrides with lower Tc values. In this regard, sulfur, with its slightly higher electronegativity than hydrogen (as shown in Table 1), is an ideal candidate for creating a covalent metal with hydrogen.

ELEMENTS	ELECTRONEGATIVITY
Hydrogen	2.2
Sulfur	2.58
Carbon	2.55
Oxygen	3.44
Nitrogen	3.04
Yttrium	1.22

Table.1 *Electronegativity of selected lighter element.*

The similar electronegativity values of carbon and sulfur, as shown in Table 1, sparked my curiosity in exploring carbon as a potential candidate for my research. Interestingly, hydrogen, due to its lighter mass, demonstrates a high phonon frequency, roughly at ~0.2 eV. Carbon systems, surprisingly, also exhibit a phonon frequency of approximately ~0.2 eV. Furthermore, carbon has the beneficial property of forming strong covalent bonds while retaining the versatility to create a variety of compounds. In comparison, the potential to increase the critical temperature (Tc) in binary systems seems somewhat limited, whereas ternary systems present a wider range of possibilities for exploration.

Motivated by carbon's capacity to form effective covalent bonds, and building on my research on superconductivity in dense carbon disulfide (CS2), my interest naturally extended to seeking high Tc superconductors within ternary compounds of carbon, sulfur, and hydrogen. I delved into this area and observed superconductivity in this ternary system. The idea of carbonaceous sulfur hydride (CSH) and my results were introduced as early as my Carnegie Fellowship interview in 2012, a fact that could be verified by contacting Dr. Viktor Struzhkin, who was present in those discussions as part of the Carnegie Fellowship committee. Additionally, my faculty application for the University of Rochester in 2017 also included mentions of CSH, illustrating the longstanding nature of these ideas and experimental outcomes. From 2016 to 2018, I engaged in extensive discussions about these concepts with theorists like Chris Pickard, who conducted preliminary work in this area.

All the significant results I have achieved are a product of careful and insightful research efforts. The development of the LuHN system is a prime example of this approach. Even before the exploration of low-pressure high-temperature superconductivity became prominent, I was advocating for its potential as a future direction in our field. I was among the first to consider incorporating nitrogen in this pursuit. Importantly, many of these materials were not anticipated by theoretical models, and my research often advanced ahead of theoretical developments. It is important to acknowledge that while other prominent experimentalists, such as Eremets, have often conducted measurements guided by prior predictions, I have consistently relied on my original ideas. Thus, the suggestion by the Investigation Committee that my achievements are unfounded or mere wishful thinking is quite disheartening, considering the dedication and integrity of my scientific journey.

As I previously discussed, the formulation of theories can sometimes be influenced by subjective judgments, such as the perceived unusual nature of data or discrepancies with expected results. An example of this occurred in the Investigation Committee's assessment, where a conclusion was drawn prematurely without an exhaustive examination of the resistance data at 20 kbar on the LuHN sample. The Committee has formed a premature conclusion that implies I have resampled and shifted the data. With due respect, I must assert that this accusation does not reflect the truth. The methodologies and integrity of my research do not involve such practices. This approach by the Investigation Committee raises concerns about the thoroughness of the investigative process. For a visual representation, please refer to Figure 1 below.

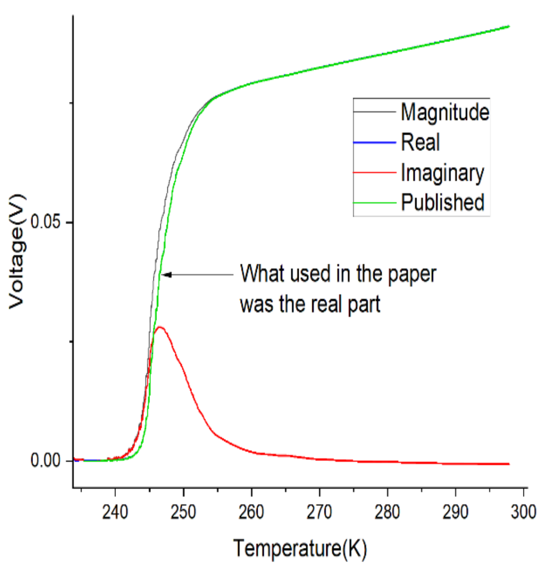


Figure 1 displays the real part of the data, which was used as resistance data. It seems that the Investigation Committee may have focused primarily on the magnitude component, which might suggest a need for further familiarity with this specific experimental context. In an unforeseen turn of events, the Committee has made allegations of data resampling and shifting against me. However, these accusations seem to be based more on assumptions than on substantiated evidence. Given these observations, there might be some concerns regarding the credibility of the Investigation Committee's findings. I believe it's important for all aspects of the data to be considered and understood in their proper scientific context to ensure a comprehensive and accurate assessment.

Another noteworthy example involves an anonymous author who submitted a comment to Nature, expressing concerns about the behavior of the R versus T data near room temperature in the 16 kbar dataset, labeling it as "unusual." The author specifically pointed out the presence of substantial noise, which is a frequent characteristic in resistance data. Additionally, the author observed that the noise or scatter did not follow the "typical" Gaussian pattern expected in such data.

Upon conducting further experiments, we were able to determine that the noted behavior might be linked to the bandwidth of the digital filter used, specifically a Gaussian Finite Impulse Response (FIR) filter, and its relationship with the actual spread (ΔR) of resistance measurements around the mean value. Consequently, the "unusual" behavior identified by the anonymous author could be explained by a significant spread in the ΔR data relative to the filter bandwidth of the Model SR860 lock-in amplifier used in our experiments.

It's important to acknowledge that these observations did not lead to any formal accusations from the editors of the journal or other members of the scientific community. This situation underscores the necessity of dedicating considerable effort and time to fully understand the complexities and nuances of data, especially in highly specialized fields of scientific research.

In addressing the claims of data fabrication related to superconductivity, it is pertinent to consider the crucial question of how data that is allegedly fabricated could be independently replicated and demonstrated in front of numerous scientists at a leading national laboratory, such as the U. S. Department of Energy Office of Science's Advanced Photon Source (APS) at Argonne National Laboratory, and later shown to exhibit a superconducting gap for the first time at another esteemed national laboratory, namely Brookhaven Lab. Presented below are the results from multiple measurements carried out on the synthesized carbonaceous sulfur hydride (C-S-H) superconductor, notable for its remarkably high Tc at lower pressures, using advanced techniques:

Compositional Tuning of Tc: The synthesis of the C-S-H material involved the previously described method of compositional tuning of Tc. We employed a modulated AC susceptibility technique to detect the onset of superconductivity. Our results indicated a superconducting transition at about ~260 K at 133 GPa for a C-S-H sample. This finding highlights a significantly lower pressure threshold for achieving the same Tc compared to the initial syntheses, suggesting the material's adaptability to lower pressures (please see Figure 2).

Synchrotron IR Measurements: Synchrotron IR measurements within the energy range of 70 to 170 meV were performed on the same C-S-H sample. These measurements showed a marked decrease in reflectivity below Tc compared to the normal state at temperatures below 100 K. The measured superconducting gap was approximately ~85 meV at 100 K, closely aligning with the BCS theoretical prediction of ~80 meV for a Tc of 260 K, which supports the conventional nature of the superconductivity.

Structural Analysis: To deepen our understanding, we directly probed the structure of the superconducting phase using synchrotron single-crystal x-ray diffraction, alongside measuring the Meissner effect through AC susceptibility. These independent experiments not only corroborated the very high Tc previously identified in the C-S-H system at higher pressures but also provided valuable structural insights.

In conclusion, these findings emphasize the robustness and reproducibility of the data, as evidenced by experiments conducted at renowned national laboratories. The comprehensive and rigorous nature of these investigations further substantiates the validity of the scientific work in question.

* * *

The direct measurement of a material's magnetic behavior during its transition to the superconducting state, particularly the expulsion of external magnetic fields, is crucial in confirming superconductivity. A standard setup for this involves two coils: one generates an AC magnetic field (known as the "primary/excitation coil"), and the other detects the magnetic field by measuring the induced voltage (referred to as the "secondary/pickup coil"). Placing the sample between these coils leads to an induced electromotive force (voltage) proportional to the average magnetic susceptibility of the volume encompassed by the coil, which directly correlates to the sample's magnetic susceptibility under constant conditions. This fundamental technique is widely known as the single-frequency AC susceptibility method.

In practical scenarios, variations in environmental conditions introduce challenges, resulting in a residual background voltage. These variations can stem from geometric disparities between the coils, asymmetrical deformations of the coils due to temperature changes, and the non-uniform magnetic flux arising from the metallic components in the Diamond Anvil Cell (DAC). These factors can make it difficult to detect the superconducting transition due to a non-zero, temperature-dependent background signal.

To improve the sensitivity of this technique for small-scale samples like those in a DAC, a double-frequency method has been developed. This method involves intentionally suppressing the superconducting state at the onset of the transition using a high-amplitude modulation field. This approach leverages the critical field behavior of superconductors. Specifically, a small excitation field at a higher frequency is used to measure the diamagnetic change in the sample, while a stronger modulation field at a lower frequency suppresses the superconducting state at twice the modulation frequency. This suppression, occurring at both the peak and trough of the modulation field, provides important information about the superconducting behavior of the material being studied.

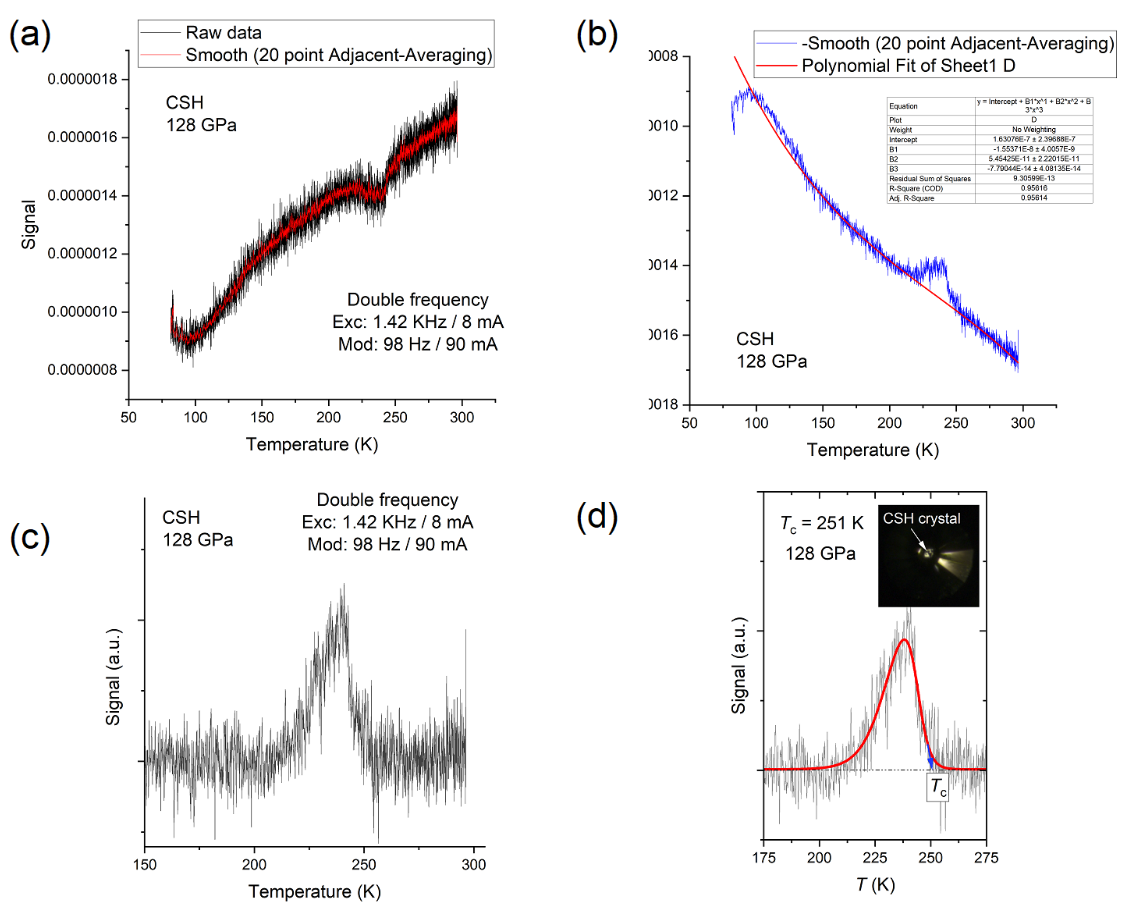


Figure 2. Modulated AC magnetic susceptibility measurements of carbonaceous sulfur hydride at 133 GPa showing the clear peak as the sample enters the superconducting state with maximum T_c of 260 K at 128 GPa. The blue arow indicates the superconducting transition temperature.

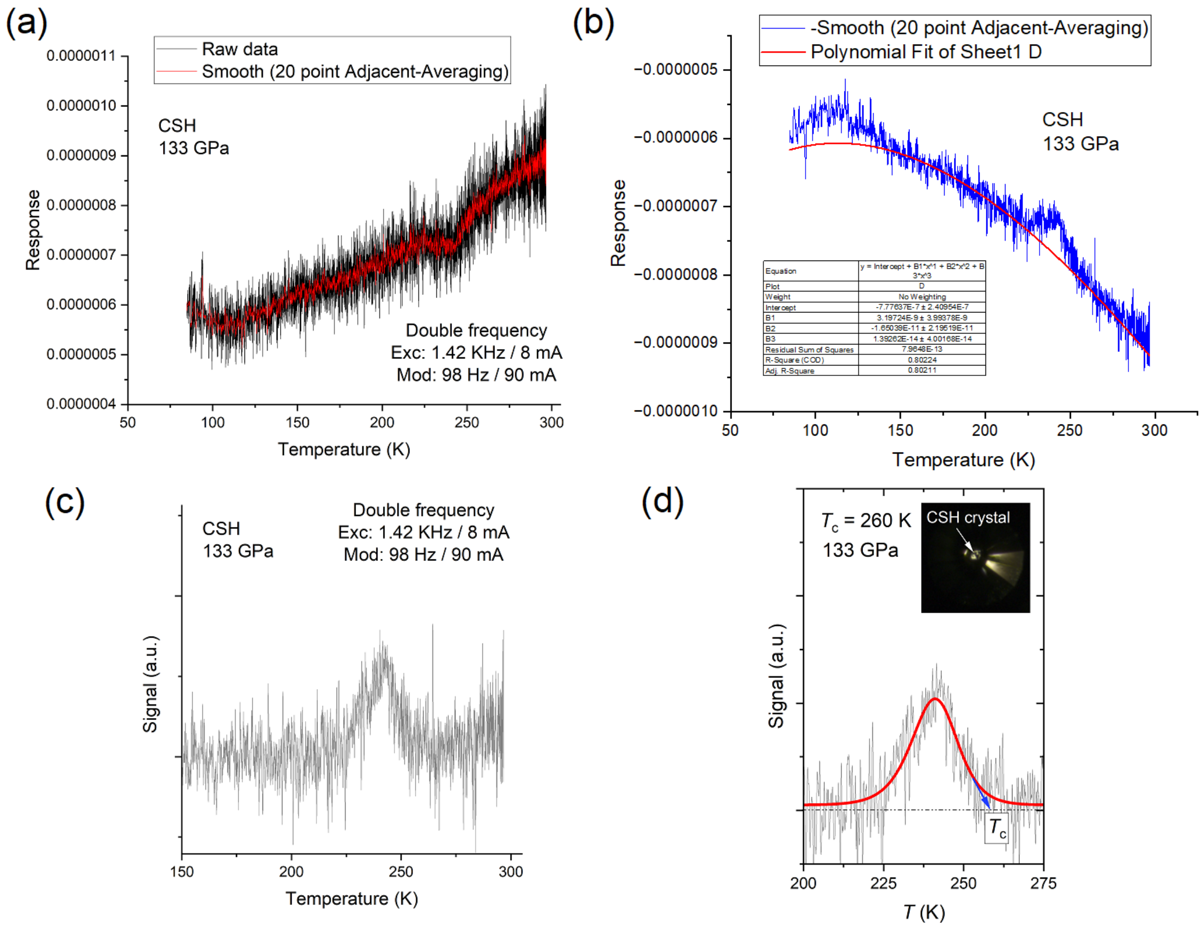


Figure 3. Modulated AC magnetic susceptibility measurements of carbonaceous sulfur hydride at 133 GPa showing the clear peak as the sample enters the superconducting state with maximum T_c of 260 K at 133 GPa. The blue arow indicates the superconducting transition temperature.

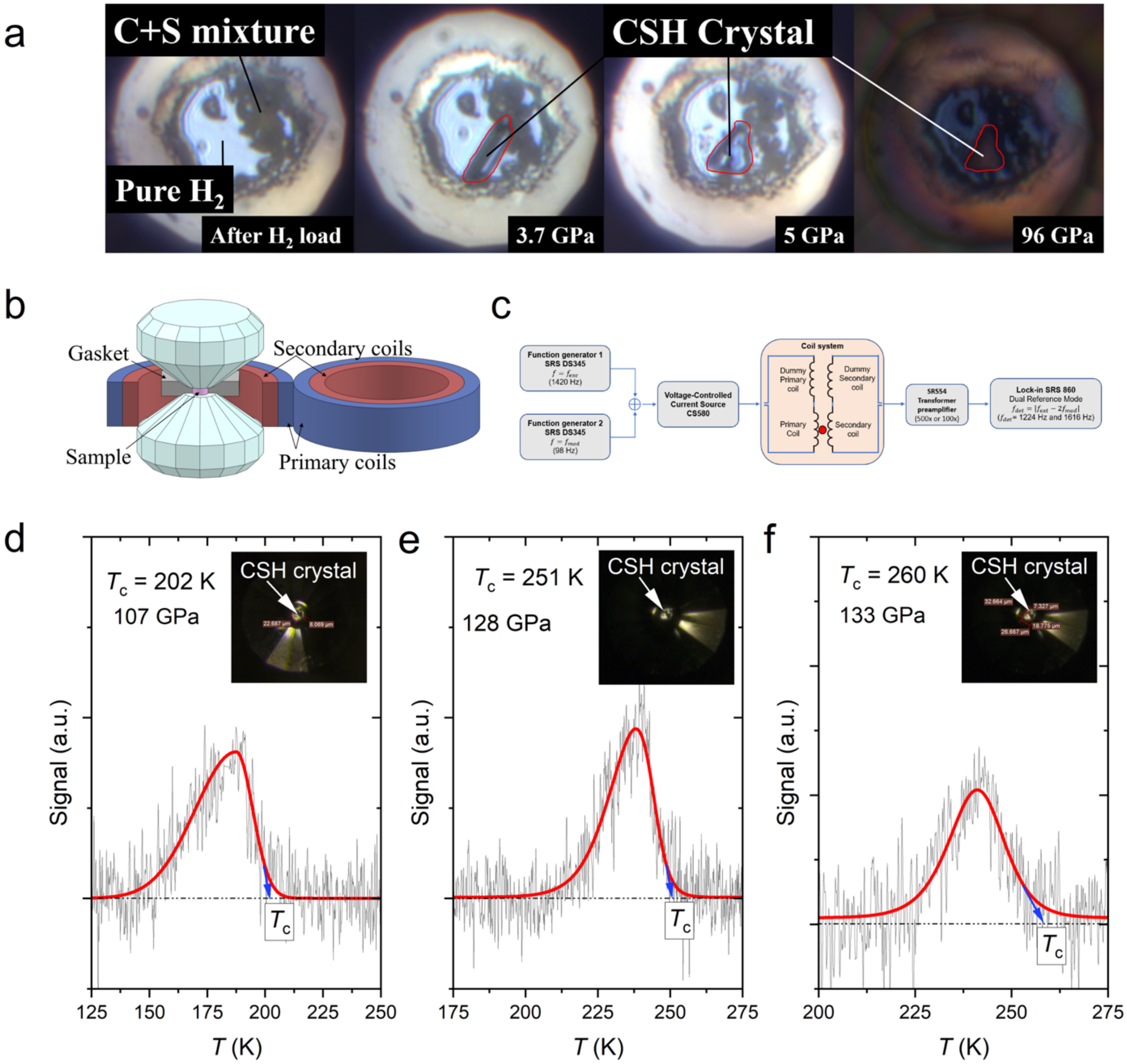


Figure 4. (a) Micrographs taken from inside a diamond anvil cell showing the different stages of crystal growth for C-S-H at varying pressures. At 5 GPa the C-S-H crystals are transparent with transmitted light and by 96 GPa the crystal has metallized and is opaque and reflective. (b) Schematic representation of the side-by-side coil system surrounding the diamonds and sample chamber within a DAC. (c) Block diagram of the modulated AC susceptibility experimental setup. Excitation and modulation signals are produced by function generators 1 and 2, respectively. In between the brackets are examples of excitation and modulation frequencies. The coil system is installed in a cryostat inside the DAC. The response is measured by a lock-in amplifier in dual reference mode. The basic DAC magnetic susceptibility technique applied here represents an extension of methods applied previously that have led to the discovery and characterization of new superconductors at megabar pressures. (d—f) Modulated AC magnetic susceptibility measurements of carbonaceous sulfur hydride at several pressures showing the clear peak as the sample enters the superconducting state with maximum Tc of 260 K at 133 GPa. The blue arow indicates the superconducting transition temperature.

Synchrotron infrared (IR) spectroscopy has played a key role in uncovering the superconducting properties of the C-S-H phase within its superconducting state. This was observed alongside AC susceptibility measurements that indicated a transition at 260 K under a pressure of 133 GPa. This is in notable contrast to infrared measurements on H3S, which primarily examined the mid-IR spectra using a conventional IR source. That study also discussed aspects related to the low-energy spectral range and the superconducting gap. It should be mentioned that while the use of a synchrotron source was contemplated, the analysis was based on data obtained with a conventional source.

The superconducting gap measured at ~85 meV at 100 K closely matches the theoretical predictions of the BCS theory. The BCS theory suggests a gap energy of $2\Delta(0) = 3.528 k_B T_C$; with T_c of 260 K. Notably, the independently measured Tc value of 260 K, determined through magnetic susceptibility measurements, yields the calculated superconducting gap ($2\Delta(0)$) ~80 meV. This close correlation with the BCS prediction strongly supports the concept of conventional superconductivity, despite the exceptionally high critical temperature (Tc).

In this research endeavor, we have undertaken a comprehensive examination of specific C-S-H samples, affirming the validity of our measurement techniques for determining the superconducting transition temperature and corroborating previously established methodologies. Our selection of a particular C-S-H compound, one that can be synthesized under lower pressures, has enabled us to focus our investigations on magnetic susceptibility measurements pertaining to the Meissner effect. Additionally, it is important to note that within the realm of C-S-H, there exist higher pressure structures and compositions, as demonstrated by 2020 Nature paper, ultimately unveiling the existence of a room temperature superconductor within this compound. Compositional tuning of the carbon content and phase of the C-S-H system has been shown to be a way forward to lower the required pressures for superconductivity while still maintaining very high critical transition temperatures compared to the H_2S and H_2S+H_2 derived superconductors.

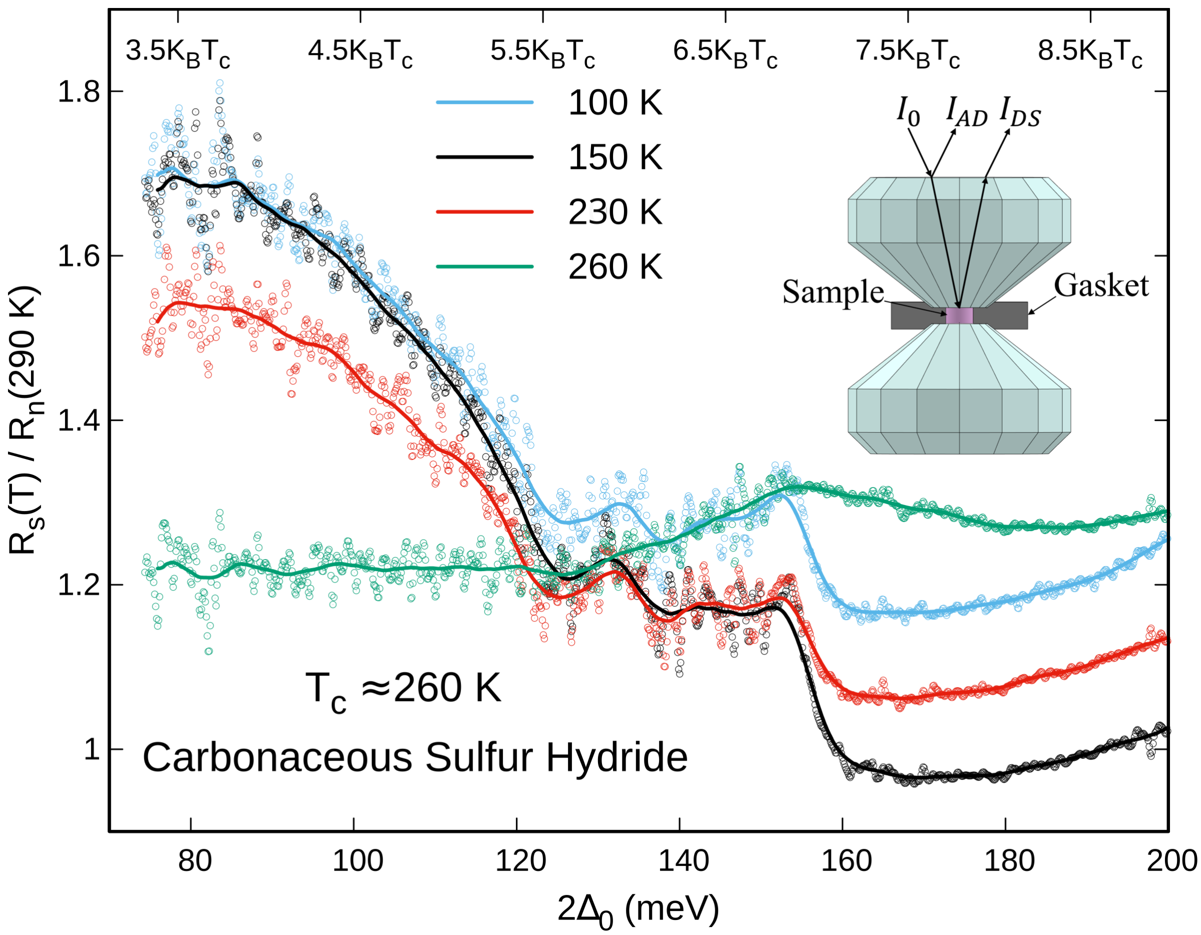
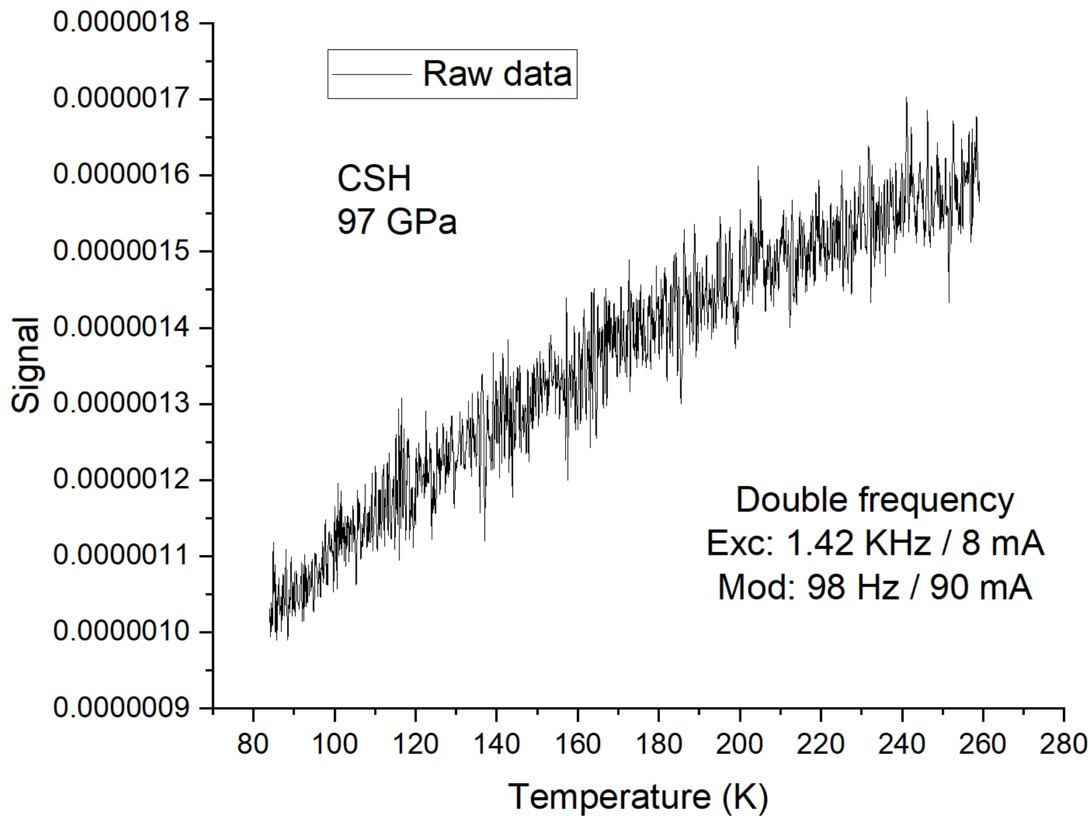


Figure 5. Synchrotron infrared reflectivity of the C-S-H superconductor. The $R(T)/R_n$ curves for 260 K, 230 K, 150 K and 100 K, with 290 K (normal state) as the reference. The results give a maximum superconducting gap for the C-S-H sample of ~85 meV at 100 K and 133 GPa. The inset shows the schematic of the ray diagram for reflectivity measurements.

A null signal, at 97 GPa. No superconductivity was observed.



* * *

5. The Investigation Committee's Research, Analysis, and Understanding is Flawed

The Investigation Committee's research, analysis, and understanding seem to exhibit certain limitations, which are evident in their approach to examining both the data and its contextual elements. This approach appears to be somewhat imprecise and could potentially be influenced by biases or preconceived notions. Consequently, it raises respectful questions about the thoroughness of the Investigation Committee's ability to conduct a comprehensive investigation.

The Committee has put forward the claim that the carbonaceous sulfur hydride (CSH) being examined was derived from CH4 and represents a form different from the CSH described in the Nature paper. To thoughtfully explore these matters, it's beneficial to closely review the Committee's summary related to the study. An excerpt from this summary, which I believe is particularly relevant, has been provided as a screenshot for reference. It's crucial to focus on the highlighted sections, as they pinpoint an area of notable concern.

- **Fabrication and/or falsification of Figure 1a and Figure S13, R(T) data (resistance as a function of temperature)**

Context:

The Chem. Commun. 2022 Paper was submitted on June 5, 2022 and published on July 6, 2022. During this time period, Interviewee 7 and Respondent had been informed by *Nature* editors that the Nature 2020 (CSH) Paper was to be retracted.[181] In the Chem. Commun. 2022 Paper, x-ray diffraction measurements at room temperature and first-principles numerical simulations are combined with electrical resistance measurements as a function of temperature (R(T)), which reveal drops to zero resistance that indicate superconducting behavior in CSH samples synthesized from methane, sulfur, and hydrogen gas (which is different from the method reported in the Nature 2020 (CSH) Paper).

Contrary to the understanding of the Investigation Committee, the paper in question on its second page clearly states the following procedure:

> "All crystals of C–S–H here are synthesized using the procedure of Snider et al.8 (full details in ESI†). Ball-milled mixtures of elemental C and S with dimensions about 15% of the diamond culet (typically 100–250 mm) are placed into the sample chamber of a diamond anvil cell, along with a ruby sphere. Gas phase H2 is loaded at 0.3 GPa. Samples are then pressurized to 3.7–4.0 GPa and excited for several hours using light from a 514 nm laser with power ranging from 10 and 150 mW depending on sample response. Crystal growth is monitored in situ by visual observation, and Raman spectroscopy confirms the transformation into C–S–H by the presence of characteristic C–H, S–H, and H–H Raman modes. Samples are compressed to 10 GPa after transformation and characterization by Raman spectroscopy to avoid decomposition."

It is quite clear to any careful reader that the methodology described is consistent. The Investigation Committee seems to have approached their review with a presumption of misconduct, which might be affecting their interpretation of the data and context, possibly leading them to view things through a lens of fabrication or falsification rather than engaging in a thorough and unbiased examination. As a result, a lack of impartiality within the Committee becomes somewhat apparent.

It is crucial to highlight that the retraction of the aforementioned paper was not the result of any substantiated allegations of data fabrication or misconduct uncovered through a formal review process. Rather, it was initiated by the corresponding author, Ashkan Salamat, who personally reached out to the journal editors to request the retraction. This decision seems to have been influenced by retaliatory intentions, possibly aimed at damaging my reputation, following Mr. Salamat's departure from Unearthly Materials, Inc. due to various financial considerations.

Before discussing the specific concerns, it's important to acknowledge certain noticeable and regrettable errors exhibited by the Investigation Committee during their review of the LuHN investigation, as detailed earlier. We respectfully summarized these shortcomings to include:

1. The Committee seemed to have a limited understanding of AC resistance data analysis, particularly in interpreting the real and imaginary components of the signal.

2. Respectfully, there appears to be a lack of comprehension/experience regarding the representation of zero resistance in the high-pressure field.

3. The Committee seemed to display a limited familiarity with the concept of phase adjustments in data analysis. It's noteworthy to mention that in high-pressure superconductivity research, such as the studies conducted by Prof. James Schilling's group, phase adjustments are often considered and factored into the analysis, even though they may not be explicitly mentioned in the publications.

4. The potential issues stemming from the inversion of the direction of the AC signal, arising from various phase-shifting challenges within a measurement system, were not thoroughly addressed.

5. Notably, only one graduate and one undergraduate student in my research group had a complete understanding of these techniques and data. Unfortunately, the Committee did not engage these students for their insights or interviews, which might have been beneficial.

6. Moreover, there is a concern that the Investigation Committee may have selectively presented information in a way that seemed to support preconceived narratives, thereby potentially affecting the objectivity of their conclusions.

The persisting gaps in understanding and the flawed analytical approach of the Investigation Committee seem to have influenced their preliminary assessment of the current paper, as demonstrated by the inaccuracies in their conclusions outlined below:

- Data file sizes, ranging from 1,963 to 28,277 readings, were deemed smaller than the anticipated 50,000 readings during cool-down.

- Datasets were truncated at temperatures approximately near 100 K in all instances, except for one.

- Significant disparities in slope and curvature were identified near room temperature (295 K) in contrast to a typical cool-down experiment.

- Temperature differences exhibited behavior markedly different from the expected digitization (±0.001 K below 100 K and ±0.01 K above 100 K) across all datasets, except for the 90 GPa dataset; the 90 GPa curve (sample "TN" in the article, Figure 1a inset) was the sole exception that did not display evidence of superconductivity.

- Examination of the temperature series in these measurements unearthed several anomalies and characteristics incongruent with the established measurement setup at the Respondent's laboratory before the publication of this work.

It seems quite clear that the Investigation Committee may have approached their assessment with certain preconceived ideas. Their contention regarding the number of data points does not seem to fully consider the variability inherent in experimental setups. The number of data points can vary significantly due to a range of experimental factors, such as cooling and warming rates, vacuum quality, the temperature range of interest, and the specific type of diamond anvil cell used. For example, breaking the vacuum can cause rapid warming, and the degree to which the vacuum is disrupted can influence the warming rate, naturally leading to differences in the number of data points.

Additionally, the selection of temperature range is a crucial element in our experiments. Typically, we concentrate on temperatures between 120 K to 150 K, focusing on high-temperature superconductivity. Therefore, investing resources in cooling down to the 5 K-10 K range wouldn't align with our specific research goals. In some instances, samples are deliberately warmed to certain temperatures before being cooled again, which can result in temperatures around 260 K or 280 K, tailored to the requirements of the experiment.

Contrary to the claim made in the figure caption, the data clearly shows a warming trend. My role in the preparation of the paper was confined to assisting with the sample and providing the data, while the writing was solely handled by the UNLV group. Unfortunately, there seems to be an error in the paper where it incorrectly describes the trend as cooling, although it is quite apparent that the data indicates a warming pattern. This discrepancy is likely a typographical error. However, the Investigation Committee continues to adhere to their narrative, suggesting that the data represents cooling and shows unusual behavior, which seems contrary to a straightforward interpretation. This approach aligns with a pattern of entering the analysis with predetermined notions, as also indicated by James Hamlin's statement about the difficulty in reconciling the data with the parameters in the LuHN EDF 15 data. To calculate resistance from our data, one would simply divide voltage by current, in our case, 2 mA. A basic calculation of this sort would clearly show that the two plots are perfectly aligned, as would be evident to most independent objective observers. It appears, though, that there might have been an unintentional oversight, leading to a misunderstanding.

It is important to note that the temperature controller we use offers a resolution of 1 millikelvin (mK). However, the configuration of the LabView program can impact how many decimal points are displayed on the temperature readout. I have noticed that the display can show anywhere from 4 to 6 decimal points, which, in practical terms, does not equate to an increase in actual temperature resolution. This point has been consistently emphasized in my communications with both the Investigation Committee and other relevant parties. In our latest experimental setup, we have taken careful steps to ensure that data collection accurately reflects the specified resolution. Therefore, when creating plots of temperature differences, it is possible to see instances of digitization if data acquisition adheres strictly to the designated resolution. However, if LabView is set to display more decimal points, minor variations might appear in the delta(T) vs. T plot.

A particular point raised by the Investigation Committee deserves careful consideration - their observation that typical cool-down behavior seems to be missing. It's crucial to reflect on what is considered "typical behavior" in such contexts. Based on my nearly 16 years of experience in

conducting low-temperature experiments, I understand that the definition of typical cooldown behavior can vary significantly depending on a wide array of experimental parameters.

To illustrate this point, I would like to present examples of cooling data. Please refer to Figure 6 for an example of linear cool-down behavior.

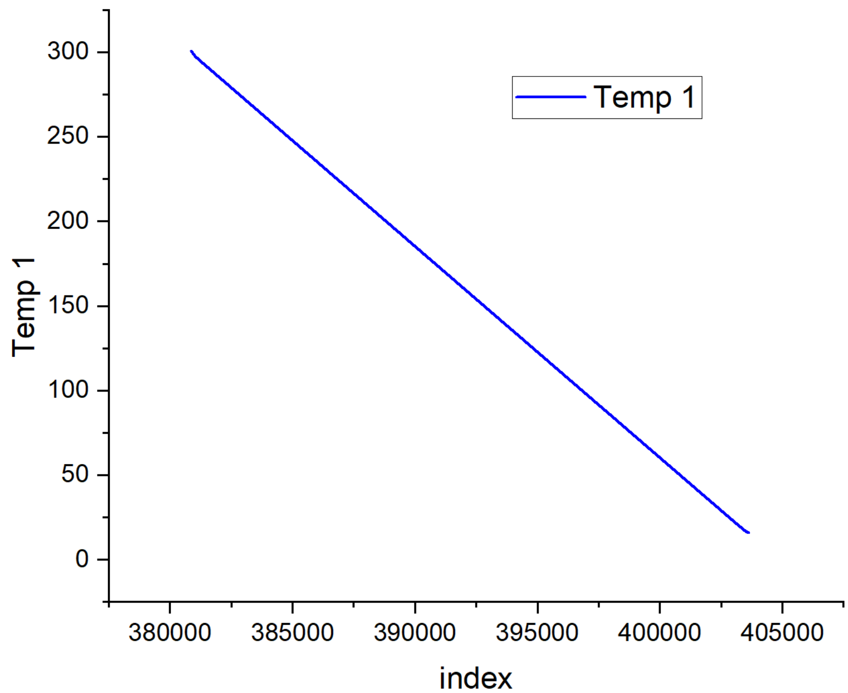


Figure 6. Contrary to the Investigation Committee's perspective, the plot above does not exhibit the purported "typical behavior" they have described. Rather, it portrays a straightforward linear pattern.

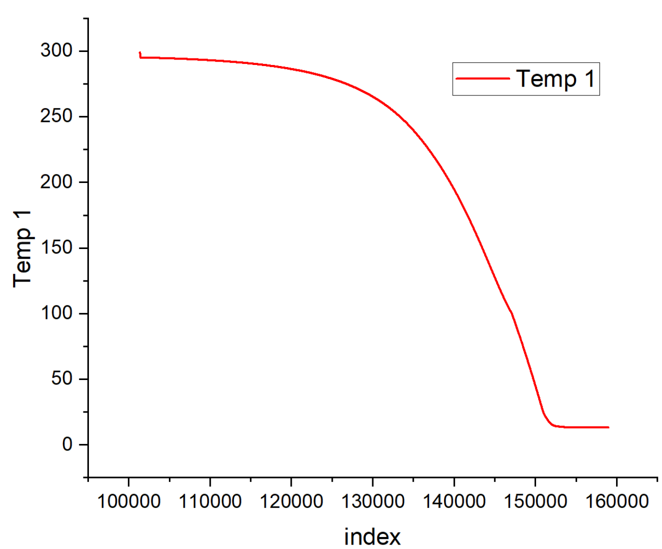


Figure 7. This plot does not depict the asserted "typical behavior" as described by the Investigation Committee.

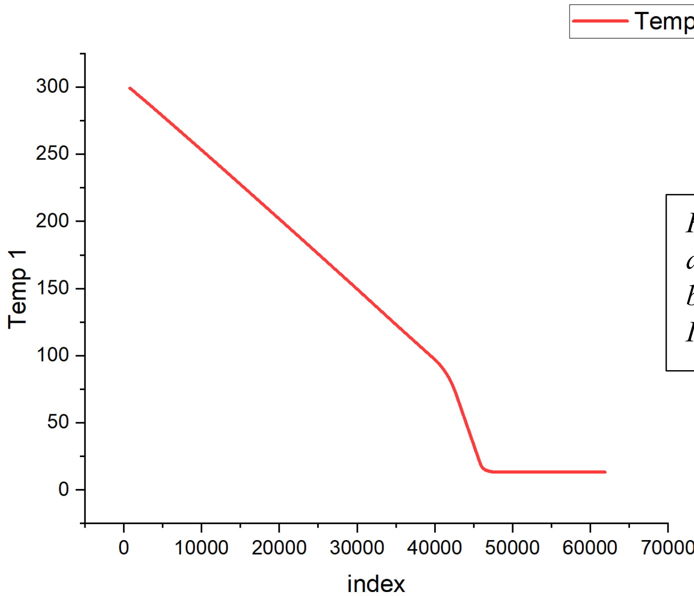


Figure 8. This plot does not depict the asserted "typical behavior" as described by the Investigation Committee.

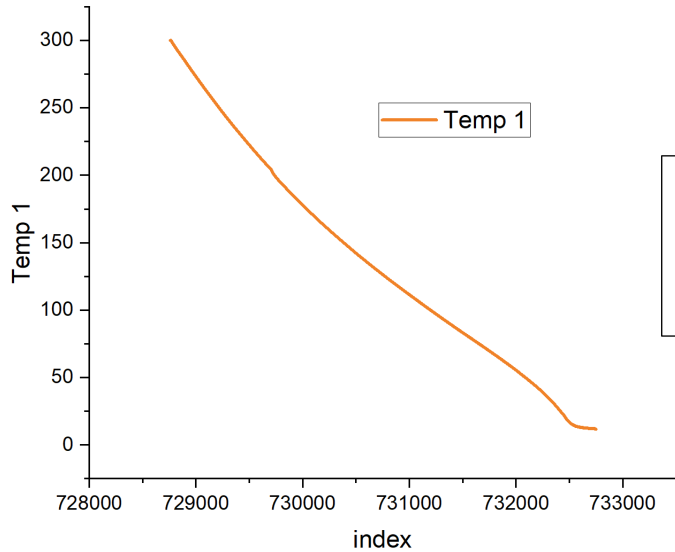


Figure 9. This plot does not depict the asserted "typical behavior" as described by the Investigation Committee.

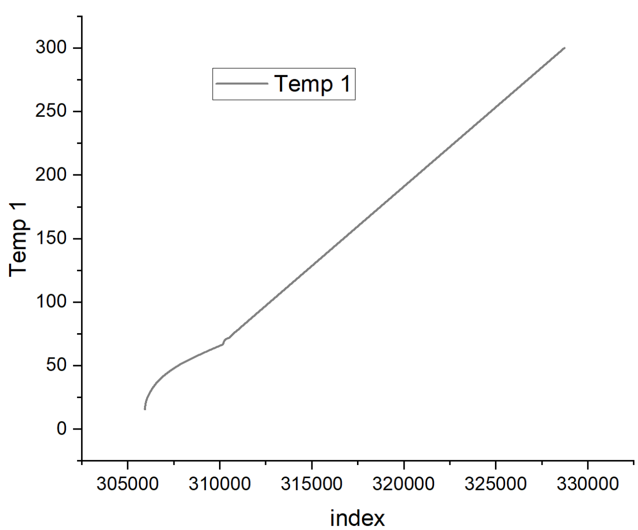


Figure 10. A warming behavior of a given experiment.

Allow me to provide exemplars of warming data.

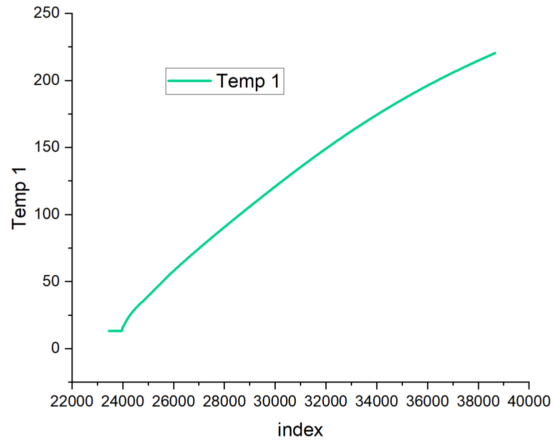


Figure 11. A warming behavior of another experiment.

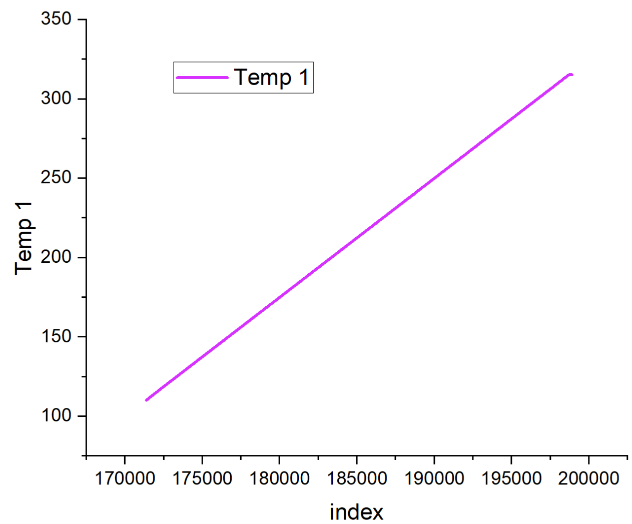


Figure 12. A warming behavior of another experiment.

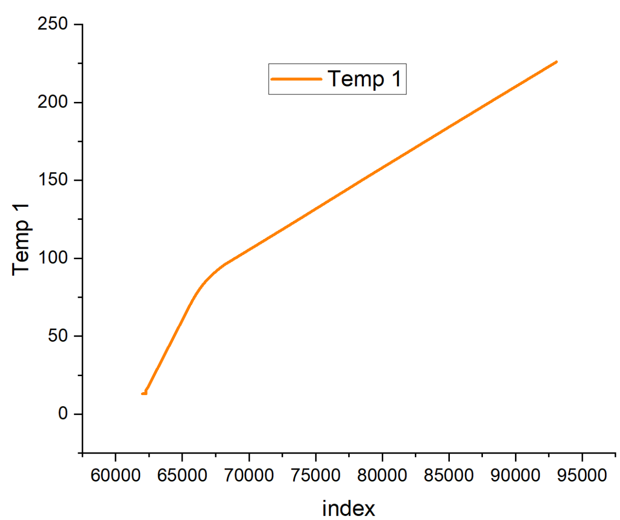


Figure13. A warming behavior of another experiment.

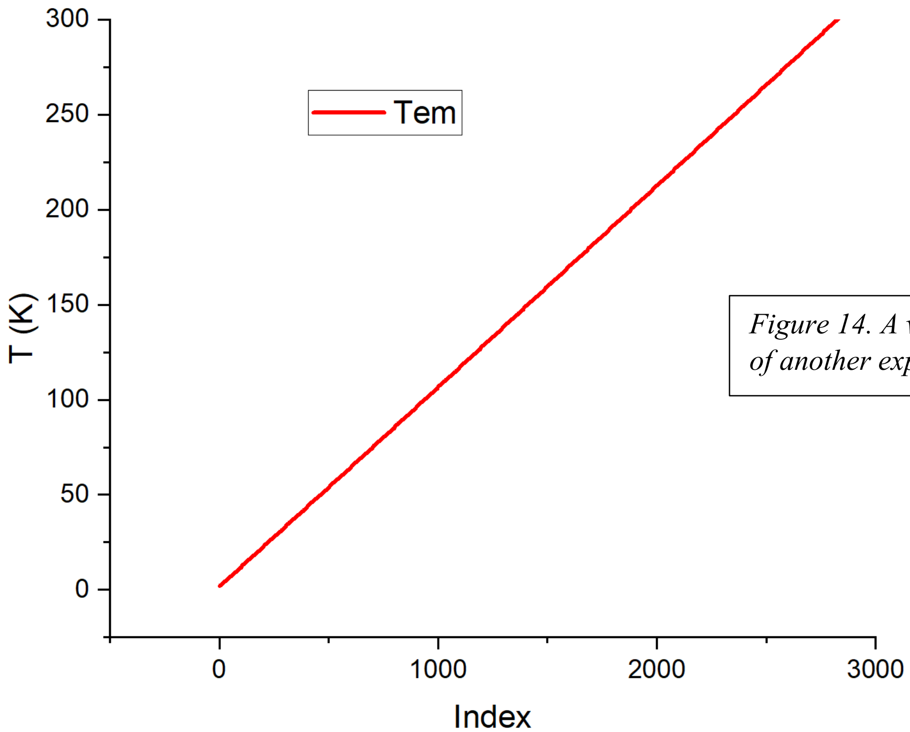


Figure 14. A warming behavior of another experiment.

The plots presented above demonstrate that the temperature data are not as unusual as the Committee has suggested.

* * *

6. Conclusion

In summarizing the issues discussed in this section, it is respectful to consider that the concerns expressed by Dr. Hirsch, Dr. Hamlin, and echoed by the Investigation Committee might be viewed from a different perspective. These concerns seem to stem from certain interpretations that could potentially align with elements like confirmation bias, apophenia, and selective skepticism. The Committee's indications of data fabrication might be more reflective of assumptions and perceptions of patterns or unusual observations, rather than being grounded in definitive evidence that adheres to the stringent criteria necessary for such serious claims.

Additionally, it's important to recognize that the Investigation Committee's research, analysis, and understanding might have certain limitations. These limitations could include a perspective in their review of the data and its context that might be perceived as having a predetermined bias. Their grasp on aspects such as AC resistance data analysis, temperature behaviors, and experimental parameters might benefit from further exploration and understanding.

The Committee's stance on the carbonaceous sulfur hydride (CSH) under study, suggesting a significant difference from the CSH detailed in the Nature paper, seems to overlook clear methodological similarities presented in both works. This observation might raise questions about the depth and objectivity of their investigation. It is also noteworthy that the retraction of the paper was initiated by the corresponding author, Ashkan Salamat, and not as a result of proven allegations of data fabrication, suggesting there may be other factors at play.

The approach of the Committee in handling data and their interpretation, which might appear to be influenced by preconceived ideas, raises some concerns about their impartiality and the independent nature of their investigation. It's important to appreciate that scientific research, particularly in specialized fields like high-pressure superconductivity, involves complexities that may not fit within typical frameworks. Recognizing these nuances is crucial for arriving at balanced conclusions.

In contrast, my research has received independent verification and validation through experiments conducted at prominent national laboratories. This supports the credibility of my scientific contributions. The Committee's interpretation of resistance data and assertions of unusual behavior underline the importance of a detailed and nuanced understanding of data and the various factors that can influence experimental results. A careful, comprehensive approach to data analysis is essential to avoid hasty or unsupported conclusions.

In closing, while the Committee's concerns about data fabrication are noted, they appear to lack a strong foundation and may be somewhat influenced by a limited understanding of the specific challenges and intricacies in high-pressure superconductivity research. The validity of my contributions to this field is reinforced by the solid nature of my findings, the successful replication of my work, and my commitment to rigorous scientific methodologies throughout my research journey.

* * *

C. Draft Report A. Nature 2020 (CSH) Paper Not Completed Due to Time Restrictions

This section has not been completed due to time restrictions imposed by the University of Rochester and my request to have until February 5, 2024 being denied. I am working to submit a complete response.

D. Draft Report B. PRL 2021 (MnS_2) Paper Not Completed Due to Time Restrictions

This section has not been completed due to time restrictions imposed by the University of Rochester and my request to have until February 5, 2024 being denied. I am working to submit a complete response.

E. Draft Report E. NSF Early Career Award Proposal Not Completed Due to Time Restrictions

This section has not been completed due to time restrictions imposed by the University of Rochester and my request to have until February 5, 2024 being denied. I am working to submit a complete response.

XI. Overall Conclusion

It is imperative to recognize that scientific disagreement and divergent interpretations of data, which are inherent and valued aspects of the scientific process, should not be erroneously equated with scientific or research misconduct as defined by the National Science Foundation (NSF). The essence of scientific advancement lies in the robust exchange of ideas, rigorous debate, and the continual re-evaluation of hypotheses and results. Misconduct, as per NSF's definition, involves acts of fabrication, falsification, or plagiarism, and must not be confused with the honest differences in opinion and interpretation that naturally arise in the course of scientific inquiry. The allegations levied against my research, primarily rooted in differing scientific viewpoints and interpretative approaches, do not meet the stringent criteria of misconduct. It is critical for the integrity of the scientific community that such distinctions are clearly understood and upheld. In the spirit of academic freedom and the pursuit of knowledge, the resolution of scientific disagreements should occur through open, constructive discourse and empirical validation, rather than being mischaracterized as misconduct.

In the course of this comprehensive response to the allegations of research misconduct leveled by the Investigation Committee of the University of Rochester, it has been my objective to provide a clear, detailed, and respectful rebuttal to each claim made against me. This response has been framed with utmost regard for professional integrity, scientific accuracy, and the principles of fair and unbiased inquiry.

The comprehensive response report, meticulously addressing the allegations of research misconduct by the Investigation Committee of the University of Rochester, culminates in a detailed, factual, and respectful denial of all claims. This overall conclusion integrates the key points from the conclusions of various report sections, emphasizing the integrity of my research, the procedural flaws in the investigation, and the misinterpretation of scientific data by the Committee. I have specifically addressed the following:

Expertise and Bias of the Investigation Committee: The composition and expertise of the Investigation Committee have been a focal point of concern. Their background in shock physics, while commendable, does not align with the specialized field of low-temperature, high-pressure superconductivity. This discrepancy in expertise raises significant questions about their ability to conduct an informed and unbiased investigation. The report underscores potential conflicts of interest and a lack of direct experience in my field, which likely led to incorrect analyses and conclusions.

University's Role and Influence: The response highlights the University's influence on the investigation, especially in actions like the removal of students from my supervision, which

seemed prejudicial and suggestive of a pre-determined outcome. Such actions indicate a lack of impartiality and objectivity, crucial in upholding the integrity of an academic inquiry.

Scientific Analysis and Data Interpretation: In addressing the specific scientific allegations, the response provides detailed clarifications and evidence, refuting claims of data fabrication or falsification. The conclusions drawn by the Committee often stemmed from a fundamental misunderstanding of the complex methodologies and nuanced interpretations inherent in high-pressure superconductivity research. Independent verification of my research by other eminent scientists further negates the allegations, underscoring the credibility and reliability of my scientific contributions.

Integrity and Transparency in Research: The response reaffirms my unwavering commitment to scientific integrity and transparency. The challenges faced in the form of accusations have been met with clear, evidence-based explanations, showcasing the robustness and consistency of the research methodologies employed. This defense is not only a vindication of my work but also an affirmation of adherence to rigorous scientific standards.

Response to Specific Accusations: Each accusation by the Committee has been addressed comprehensively, with logical explanations and supportive data. From the critical examination of experimental data to the clarification of methodological approaches, the response systematically dismantles the allegations, demonstrating the flawed nature of the Committee's assertions.

Advocacy for Scientific Inquiry and Academic Integrity: This response serves as an advocacy for the principles of fairness, objectivity, and scientific accuracy. It is a call for justice that extends beyond my personal defense, resonating with the broader academic and scientific communities. The aim is to protect the sanctity of scientific inquiry against biased and flawed investigative processes and to maintain the standards of academic integrity.

Appeal for Fair Reevaluation: The report concludes with an appeal for a fair reevaluation of the investigation's approach, emphasizing the need for involvement from experts with direct experience in low-temperature, high-pressure superconductivity. Such steps are crucial for the investigation to achieve credibility, ensure accurate conclusions, and maintain trust within the academic and scientific communities.

Furthermore, the independent verification and validation of my research by other eminent scientists and institutions stand as a testament to the reliability and significance of my work. This external corroboration not only reinforces the credibility of my findings but also highlights the need for a more nuanced understanding of the complexities inherent in groundbreaking scientific research.

The purpose of this comprehensive response, rooted in factual evidence and detailed scientific analysis, has been to defend not only my professional integrity but also to illuminate the critical need for impartial and well-informed evaluations in scientific investigations. It is a plea for justice, not only for me but for the broader academic and scientific communities, to ensure that the pursuit of knowledge is not hindered by bias, misunderstanding, or a lack of specialized expertise. This

report, therefore, serves as a call to action for upholding the principles of fairness, objectivity, and scientific accuracy in all scholarly endeavors.

* * *

I would like to formally acknowledge that the University of Rochester allocated a period of forty (40) weeks and one day, totaling 281 days, for the preparation of its draft report, spanning from March 16, 2023, to December 22, 2023. The draft report was furnished to me on the evening of December 22, 2023, immediately preceding the Christmas and New Year holiday season. In contrast, I was granted a timeframe of 5 weeks, equivalent to 24 non-holiday business days, to formulate a thorough response to this draft report. My proposal to extend this deadline to February 5, 2024, was not approved by the University of Rochester. Given these constraints, I have endeavored to the best of my ability to address the contents of the draft report within the limited timeframe allotted to me.

To the extent that the Investigation Committee is prepared to seriously address the issues that I have identified in my comprehensive response, I wish to express my sincere willingness to appropriately engage collaboratively with the Investigation Committee in addressing and rectifying the various misunderstandings evident in its draft report. My comprehensive response has highlighted several key areas where scientific and experimental interpretations, particularly pertaining to the low temperature, high-pressure superconductivity research, may benefit from further clarification and correction. I am committed to providing detailed insights and expertise to assist the Committee in accurately understanding the complexities of this research. My aim is to ensure that the final report reflects a precise and thorough understanding of the scientific principles and experimental nuances involved. I look forward to appropriate constructive and fruitful dialogue with the Committee to achieve a comprehensive and accurate representation of the research in question.

/s/ Liyanagamage R. Dias	January 29, 2024
Liyanagamage R. Dias, PhD	Date